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(71) Applicant: **FUJI HEAVY IND LTD**

(72) Inventor: **IKEDA ATSUSHI**
**KINOSHITA MASAHIRO**

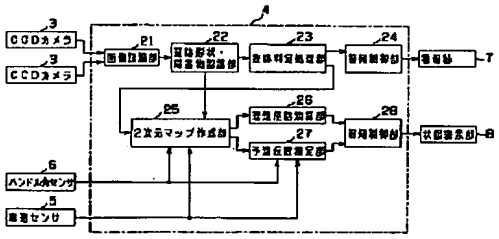
(54) **OPERATION SUPPORTING DEVICE FOR VEHICLE**

(57) Abstract:

PROBLEM TO BE SOLVED: To provide a certain, reliable, and practical operation supporting device in which a driver can travel in a narrow road by evading contact with an obstacle by easily and quickly making accurate judgment.

SOLUTION: A speed V and a handle angle 9 are detected, the environment of a traveling direction is image picked-up by a CCD camera 3, and the calculation of relative position information is operated by a picture recognizing part 21 and a road shape and obstacle recognizing part 22. When a narrow road is present in the direction of travel according to judgment by a narrow road judgment processing part 23, second-dimensional maps prepared in the past are successively updated, and the second-dimensional map of environment in the surrounding of a vehicle including the direction of travel is prepared by a second-dimensional map preparing part 25. Afterwards, an ideal path when the vehicle is intruding into the narrow road is calculated based on the second-dimensional map by an ideal path calculating part 26, and an expected position after the set time of a vehicle 1 is expected on the second-dimensional map by an expected position estimating part 27. Then, an announcement controlling part 28 outputs a signal to a state display part 8, and the ideal path is synthesized with the expected position and displayed on the second-dimensional map.





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(71)出願人　000005348
富士重工業株式会社
東京都新宿区西新宿一丁目７番２号

(72)発明者　池田　敦
東京都三鷹市大沢３丁目９番６号　株式会社スバル研究所内

(72)発明者　木下　昌裕
東京都三鷹市大沢３丁目９番６号　株式会社スバル研究所内

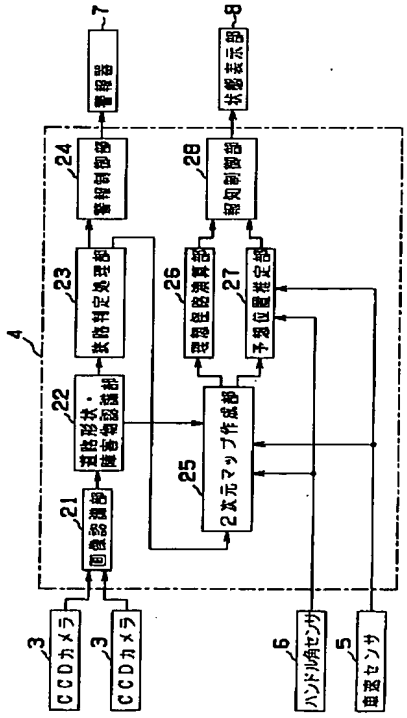
(74)代理人　弁理士　伊藤　進

(54)【発明の名称】　車両用運転支援装置

(57)【要約】

【課題】運転者が容易に素早く的確な判断を行って障害物との接触を回避して狭路走行ができ確実で信頼性、実用性が高い。

【解決手段】速度Ｖ、ハンドル角θを検出し、ＣＣＤカメラ３で走行方向の環境を撮像して画像認識部２１、道路形状・障害物認識部２２で相対位置情報の計算を行なう。狭路判定処理部２３での判定で進行方向に狭路有りの場合、２次元マップ作成部２５で、過去に作成した２次元マップを次々に更新して走行方向を含む自車両１周辺の環境の２次元マップを形成する。その後、理想経路演算部２６で、２次元マップに基づき、自車両１がこの狭路に進入する場合の理想の経路を演算し、予想位置推定部２７で、２次元マップ上で自車両１の設定時間後の予想位置を予想する。そして、報知制御部２８が状態表示部８に信号出力し、理想経路と予想位置とを合成して２次元マップ上に共に表示させる。



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【特許請求の範囲】

【請求項１】　自車両の走行状態を検出する走行状態検出手段と、上記自車両の走行方向の道路形状と立体物を検出する走行環境検出手段と、上記走行状態と上記道路形状と上記立体物情報に基づき上記自車両の走行方向を含む上記自車両周辺の環境の位置情報を形成する環境位置情報形成手段と、上記自車両の走行方向に狭路がある際に上記自車両がこの狭路に進入する理想の経路を演算する理想経路演算手段と、上記自車両の上記走行状態に基づき設定時間後の上記自車両の予想位置を推定する予想位置推定手段と、上記環境位置情報形成手段で形成した上記自車両周辺の環境の位置情報と上記理想経路演算手段で演算した上記理想経路と上記予想位置推定手段で推定した上記自車両の予想位置に基づき上記自車両の狭路走行をガイドする報知手段とを備えたことを特徴とする車両用運転支援装置。

【請求項２】　上記報知手段は、上記環境位置情報形成手段で形成した上記自車両周辺の環境の位置情報上に上記理想経路演算手段で演算した上記理想経路と上記予想位置推定手段で推定した上記自車両の予想位置とを表示することを特徴とする請求項１記載の車両用運転支援装置。

【請求項３】　上記報知手段は、上記理想経路演算手段で演算した上記理想経路と上記予想位置推定手段で推定した上記予想位置とに基づき上記自車両の上記予想位置の上記理想経路からの外れ量を演算するとともに、この外れ量を最小にする速度修正量と舵角修正量とを演算して所定に表示することを特徴とする請求項１又は請求項２記載の車両用運転支援装置。

【請求項４】　上記報知手段は、上記理想経路演算手段で演算した上記理想経路と上記予想位置推定手段で推定した上記予想位置とに基づき上記自車両の上記予想位置の上記理想経路からの外れ量を演算するとともに、この外れ量を最小にする速度修正量と舵角修正量とを演算して所定に音声出力し、狭路走行をガイドすることを特徴とする請求項１，２，３のいずれか一つに記載の車両用運転支援装置。

【請求項５】　上記報知手段は、上記音声出力のタイミングを上記自車両の走行状態に応じて可変して行うことを特徴とする請求項４記載の車両用運転支援装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ガードレール、側壁、駐車車両等の障害物との接触の可能性についての正確な情報を提供して狭路等への進入・走行が容易に行なえるようにドライバの運転を支援する車両用運転支援装置に関する。

【０００２】

【従来の技術】近年、車両の安全性の向上を図るため、積極的にドライバの運転操作を支援する総合的な運転支援システム（ＡＤＡ；Active Drive Assist system）が開発されている。このＡＤＡシステムは、車両の走行環境情報や自車両の走行状態から先行車両との衝突、障害物との接触、車線逸脱等の様々な可能性を推定して、安全を維持できないと予測される場合に、ドライバに対して報知、その他制御等を行なうものである。

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【０００３】上記車両の走行環境情報を得るための装置としては、レーザ・レーダ装置等が従来より公知であるが、最近では車両に搭載した複数のカメラにより捉えた車両前方の風景や物体の画像情報を処理して、道路、交通環境を実用上十分な精度と時間で三次元的に認識することが可能になってきている。

【０００４】上記ＡＤＡシステムの機能の一つである狭路進入の可否の判定や、障害物との接触防止を図って狭路の走行をガイドする狭路ガイド機能を用いるものとして駐車補助装置があり、例えば、特開平６－２３４３４１号公報に、駐車空間を決定し、駐車位置及び現在位置との位置関係に基づき演算した誘導路に沿って自車両を駐車位置に誘導すべく効率的に音声指示を行う技術が示されている。

【０００５】

【発明が解決しようとする課題】しかしながら、上記先行技術の誘導路は駐車位置及び現在位置との位置関係に基づき演算されるため、駐車位置までの間に電柱や縁石等の障害物が存在する場合はその対応が難しい。

【０００６】すなわち、駐車させる場合以外の様々な状況に対応させなければならない狭路ガイドでは、走行する方向に様々な障害物があることを考慮して形成されなければならず、例えどんな障害物があってもこれを運転者が有効に回避して容易に走行できるようにする必要がある。

【０００７】本発明は上記事情に鑑みてなされたもので、走行する方向に例えどんな障害物があっても、これを運転者に報知して、運転者が容易に素早く的確な判断を行って障害物との接触を回避して狭路走行ができるようにガイドする確実で信頼性、実用性の高い車両用運転支援装置を提供することを目的としている。

【０００８】

【課題を解決するための手段】上記目的を達成するため請求項１記載の本発明による車両用運転支援装置は、自車両の走行状態を検出する走行状態検出手段と、上記自車両の走行方向の道路形状と立体物を検出する走行環境検出手段と、上記走行状態と上記道路形状と上記立体物情報に基づき上記自車両の走行方向を含む上記自車両周辺の環境の位置情報を形成する環境位置情報形成手段と、上記自車両の走行方向に狭路がある際に上記自車両がこの狭路に進入する理想の経路を演算する理想経路演算手段と、上記自車両の上記走行状態に基づき設定時間後の上記自車両の予想位置を推定する予想位置推定手段と、上記環境位置情報形成手段で形成した上記自車両周

辺の環境の位置情報と上記理想経路演算手段で演算した上記理想経路と上記予想位置推定手段で推定した上記自車両の予想位置に基づき上記自車両の狭路走行をガイドする報知手段とを備えたものである。

【０００９】上記請求項１記載の車両用運転支援装置は、走行状態検出手段で自車両の走行状態を検出し、走行環境検出手段で上記自車両の走行方向の道路形状と立体物を検出し、環境位置情報形成手段で上記走行状態と上記道路形状と上記立体物情報に基づき上記自車両の走行方向を含む上記自車両周辺の環境の位置情報を形成する。そして、理想経路演算手段で上記自車両の走行方向に狭路がある際に上記自車両がこの狭路に進入する理想の経路を演算し、予想位置推定手段で上記自車両の上記走行状態に基づき設定時間後の上記自車両の予想位置を推定して、報知手段で上記環境位置情報形成手段で形成した上記自車両周辺の環境の位置情報と上記理想経路演算手段で演算した上記理想経路と上記予想位置推定手段で推定した上記自車両の予想位置に基づき上記自車両の狭路走行をガイドする。

【００１０】また、請求項２記載の本発明による車両用運転支援装置は、請求項１記載の車両用運転支援装置において、上記報知手段は、上記環境位置情報形成手段で形成した上記自車両周辺の環境の位置情報上に上記理想経路演算手段で演算した上記理想経路と上記予想位置推定手段で推定した上記自車両の予想位置とを表示するもので、運転者は上記自車両周辺の環境位置情報上に表示された上記理想経路と上記自車両の予想位置を視認することにより、障害物の回避の可能性を容易に認識できるとともに、これから行うべき運転操作も素早く容易に認識でき、また気付いていない障害物情報も知ることができる。

【００１１】さらに、請求項３記載の本発明による車両用運転支援装置は、請求項１又は請求項２記載の車両用運転支援装置において、上記報知手段は、上記理想経路演算手段で演算した上記理想経路と上記予想位置推定手段で推定した上記予想位置とに基づき上記自車両の上記予想位置の上記理想経路からの外れ量を演算するとともに、この外れ量を最小にする速度修正量と舵角修正量とを演算して所定に表示するもので、運転者はこれから行うべき速度修正量と舵角修正量を視認して、これから行うべき運転操作をより素早く容易に認識できる。

【００１２】また、請求項４記載の本発明による車両用運転支援装置は、請求項１，２，３のいずれか一つに記載の車両用運転支援装置において、上記報知手段は、上記理想経路演算手段で演算した上記理想経路と上記予想位置推定手段で推定した上記予想位置とに基づき上記自車両の上記予想位置の上記理想経路からの外れ量を演算するとともに、この外れ量を最小にする速度修正量と舵角修正量とを演算して所定に音声出力し、狭路走行をガイドするもので、運転者が障害物位置を車内の表示等を視認して確認することができなくても確実に上記理想経路に沿うようにガイドされる。

【００１３】さらに、請求項５記載の本発明による車両用運転支援装置は、請求項４記載の車両用運転支援装置において、上記報知手段は、上記音声出力のタイミングを上記自車両の走行状態に応じて可変して行うもので、車両速度、加速度等のパラメータにより適切な時期に音声ガイドされて運転操作が一層容易になる。

【００１４】

【発明の実施の形態】以下、図面に基づいて本発明の実施の形態を説明する。図１～図９は本発明の実施の第１形態に係わり、図１は車両用運転支援装置の機能ブロック図、図２は車両用運転支援装置の概略構成図、図３は狭路ガイド制御のフローチャート、図４は２次元マップ作成ルーチンのフローチャート、図５は狭路判定の範囲の説明図、図６は車両周辺の立体物位置情報の説明図、図７は前回の立体物位置情報を移動させる際の説明図、図８は車両前方の狭路に理想経路を設定する一例を示す説明図、図９はモニタへの表示の一例を示す説明図である。

【００１５】図２において、符号１は自動車等の車両（自車両）であり、この自車両１に、狭路進入の可否の判定や、障害物との接触防止を図る機能を一つの機能として有し、ドライバの運転を支援する車両用運転支援装置２が搭載されている。以下、本発明の実施の第１形態では、車両用運転支援装置２の狭路進入の可否の判定や、障害物との接触防止を図る機能の部分についてのみ説明し、他の機能の部分については説明を省略する。

【００１６】上記車両用運転支援装置２は、ステレオ光学系として例えば電荷結合素子（ＣＣＤ）等の固体撮像素子を用いた１組の（左右の）ＣＣＤカメラ３を有し、これら左右のＣＣＤカメラ３は、それぞれ車室内の天井前方に一定の間隔をもって取り付けられ、車外の対象を異なる視点からステレオ撮像するようになっている。そして、上記１組のＣＣＤカメラ３で撮像した自車両１の走行方向の映像信号は、制御装置４に入力されるようになっている。

【００１７】また、上記車両用運転支援装置２は、走行状態検出手段として、上記自車両１の速度を検出する車速センサ５とハンドル角を検出するハンドル角センサ６からの各信号が上記制御装置４に入力されるように形成されており、上記制御装置４は上述の各情報（ＣＣＤカメラ３からの映像信号、車速センサ５およびハンドル角センサ６からの各信号）に基づいて狭路進入の可否の判定や、障害物との接触防止を図って狭路の走行をガイドする機能を達成すべく、警報器７と状態表示部８に制御出力するように構成されている。

【００１８】上記警報器７は、例えばブザー等であり、進入ができない寸法の狭路に走行していった場合や、走行を続けると障害物との接触の可能性が有る場合に上記

制御装置４からの出力信号により警報音を発してドライバに報知するようになっている。

【００１９】また、上記状態表示部８は、上記制御装置４からの出力信号に応じて、車内に設けたモニタ等に、例えば図９に示すように、自車両１と障害物（塀H0，駐車車両H1，H2，電柱H3）との位置関係や、自車両１がこのままの運転状態（ハンドル角θ、車両速度Ｖ）を維持した場合の設定時間後（例えば、２秒後）の予想位置１’、および狭路を走行するための理想的な経路ＲＲを上面から見た２次元マップで視覚的に表示するようになっている。図９に示す場合では、例えば理想的な経路ＲＲを青色で、各障害物を赤色で、設定時間後の予想位置を黄色でというようにカラー表示で解りやすく表示されるようになっている。

【００２０】上記制御装置４は、マイクロコンピュータとその周辺回路で形成され、図１に示すように、画像認識部２１、道路形状・障害物認識部２２、狭路判定処理部２３、警報制御部２４、２次元マップ作成部２５、理想経路演算部２６、予想位置推定部２７、報知制御部２８で主に構成されている。

【００２１】上記画像認識部２１は、上記ＣＣＤカメラ３で撮像した自車両１の走行方向の環境の１組のステレオ画像対に対し、対応する位置のずれ量から三角測量の原理によって画像全体に渡る距離情報を求める処理を行なって、三次元の距離分布を表す距離画像を生成して上記道路形状・障害物認識部２２に出力するように形成されている。

【００２２】上記道路形状・障害物認識部２２は、上記画像認識部２１からの距離画像の距離分布についてヒストグラム処理を行うことで道路・障害物等の立体物等を認識し、自車両１から見た立体物の相対位置座標（相対位置情報）の計算を行なって、上記狭路判定処理部２３と上記２次元マップ作成部２５に出力するようになっている。

【００２３】すなわち上述のように、上記ＣＣＤカメラ３，画像認識部２１および上記道路形状・障害物認識部２２で走行環境検出手段が形成されている。

【００２４】上記狭路判定処理部２３は、上記道路形状・障害物認識部２２から入力された自車両１の走行方向の相対位置情報に基づき、自車両１の走行方向の略正面の設定範囲内に狭路があるか否かの判定を行うようになっている。

【００２５】ここで、上記設定範囲は、例えば図５に示すように、走行方向が前方の場合、車体前端から約２０ｍまでの範囲で、自車両１の前方に延出した自車両１の左右の最外縁部（例えばドアミラー）の接線α1L，α1Rで囲まれる範囲と、この範囲の左右の外側にそれぞれマージンを加えた線α2L，α2Rで囲まれる範囲である。尚、遠方になるにつれ次第に大きくマージンを加えた線α2L’，α2R’で囲まれる範囲としても良い。

【００２６】そして、走行方向で極低速または静止している車両、道路端部のガードレール、縁石、家屋の塀等の障害物の間隔を計測して道路等の実質的な道幅を検出し、道幅と自車両１の車体の最大幅及び余裕分との関係で、例えば道幅が車体の最大幅に４０cmの余裕分を加算した値より小さく、車体の最大幅に１０cmの余裕分を加算した値以上ある場合に狭路有りと判定して上記２次元マップ作成部２５に出力するようになっている。

【００２７】また、上記狭路判定処理部２３での判定の結果、狭路無しの場合は、さらに十分余裕をもって通行可能か否かが判定され、通行不可と判定した（車体の最大幅に１０cmの余裕分を加算した値より狭い通行幅しかない、あるいは全く通行できる道が無い）場合は上記警報制御部２４に出力するようになっている。

【００２８】上記警報制御部２４は、上記狭路判定処理部２３からの信号で、運転者に対して通行不可能の注意をすべく、前記警報器７から警報音を発するようになっている。この場合の警報音も、障害物に近いほど音量が大きく、また間欠して行っていた警報間隔も短くなるようにして効果的に運転者に報知できるようになっている。さらに、明らかに障害物との衝突が避けられない場合、自動ブレーキ装置（図示せず）が作動されるようになっていてもよい。

【００２９】上記２次元マップ作成部２５は、環境位置情報形成手段として形成され、前記ハンドル角センサ６で検出したハンドル角θと、前記車速センサ５で検出した車両速度Ｖと、上記道路形状・障害物認識部２２からの相対位置情報を基に、過去（前回）に作成した環境位置情報（２次元マップ）を次々に更新して、自車両１の走行方向を含む自車両１周辺の環境の２次元マップを形成して、上記理想経路演算部２６と、上記予想位置推定部２７に出力するようになっている。

【００３０】上記車両周辺の環境位置情報（２次元マップ）は、図６に示すように、ＸＹ平面上に予め設定した自車両１を中心とする領域ＱＲＳＴ内の立体物の位置情報であり、今回演算して得た上記道路形状・障害物認識部２２からの相対位置情報（領域ＰＱＲ内の情報）と、前回までに得た上記道路形状・障害物認識部２２からの情報とで形成されている。

【００３１】すなわち、前回演算して記憶しておいた立体物位置情報の領域（２次元マップ）Q’ R’ S’ T’から、今回、自車両１が移動して（移動量M＝（車速）・（計測時間））、新たに上記道路形状・障害物認識部２２から領域ＰＱＲの相対位置情報を得ると、前回の２次元マップの領域Q’ R’ S’ T’を上記移動量Mだけ移動し、今回の車両位置に対する情報になるように更新するとともに、この更新した前回の２次元マップの領域Q’ R’ S’ T’から、記憶領域外に出たもののデータ（領域ＴＳＳ’ T’のデータ）と、新たに得た領域ＰＱＲの相対位置情報に重複する領域ＰＥＦのデータとを消

去し、上記領域ＰＱＲの相対位置情報を追加して今回の２次元マップの領域ＱＲＳＴを形成するようになっている。尚、図６では、解りやすくするため、車両が前進移動する場合で示しているが、車両が旋回移動する場合等でも同様にして今回の２次元マップが求められる。

【００３２】そしてこのような２次元マップを用いて狭路走行のガイドをすることにより、従来のような車両の走行方向での立体物の位置が認識できることはもちろん、一旦車両の走行方向で認識された立体物は、車両の移動に伴って車両側方になってしまった場合でもその位置を把握することができ、他にカメラあるいは立体物認識装置を特別に付加することなく、車両周辺の広い範囲で立体物の認識を行うことができるようになっている。

【００３３】ここで、検出した自車両１の移動量を基に、前回の立体物の位置情報を移動させるには、例えば、以下の算出式により行う。

【００３４】図７において、自車両１が直進する場合、Ａ点（ｘａ，ｙａ）にある物体は、Ｂ点（ｘｂ，ｙｂ）に相対的に移動する（ｘａ＝ｘｂ）。ここで、ハンドル角θによる実舵角をδとすると、直進走行時はδ＝０であり、車両の移動量をΔＭとして、ｙｂ＝ｙａ－ΔＭとなる。すなわち、直進走行時では、座標（ｘｏｌｄ，ｙｏｌｄ）で示す前回の２次元マップは、座標（ｘｎｅｗ，ｙｎｅｗ）で示す今回の新たな２次元マップに以下の２式により移動される。

$$xnew = xold \quad \cdots (1)$$

$$ynew = yold - \Delta M \quad \cdots (2)$$

＊

尚、上記実舵角δは、厳密に０でなくとも、予め設定しておいた範囲内の値であれば直進走行とみなすようになっている。この設定範囲は、車速等のパラメータにより可変設定されるものであっても良い。

【００３５】また、自車両１が旋回する場合（δ≠０の場合）、Ｂ点（ｘｂ，ｙｂ）にある物体はＣ点（ｘｃ，ｙｃ）に相対的に移動する。この旋回の中心座標Ｐｃ（ＸＣＥ，ＹＣＥ）は、ＸＣＥを実舵角δによる車両諸元に基づいて予め設定しておいたテーブルの参照により求める（ｆ（δ）で示す）ものとして、

$$XCE = f(\delta) \quad \cdots (3)$$

$$YCE = (\text{車輪軸までのオフセット}) = 0 \quad \cdots (4)$$

となる。

【００３６】さらに、旋回の回転角θｃは、カメラ位置から左後輪までのＸ方向のオフセットをＸＷとして、

$$\theta c = \Delta M / (XCE - XW) \quad \cdots (5)$$

で算出される。

【００３７】上記中心座標Ｐｃ（ＸＣＥ，ＹＣＥ）、旋回角θｃを用いて、旋回走行時では、座標（ｘｏｌｄ，ｙｏｌｄ）で示す前回の２次元マップは、座標（ｘｎｅｗ，ｙｎｅｗ）で示す今回の新たな２次元マップに以下のように移動される。

$$r = ((xold - XCE)^2 + (yold - YCE)^2)^{1/2}$$

$$a = \arctan((yold - YCE) / (xold - XCE))$$

とすると、

$$xnew = r \cdot \cos(a + \theta c) + XCE \quad \cdots (6)$$

$$ynew = r \cdot \sin(a + \theta c) + YCE \quad \cdots (7)$$

上記理想経路演算部２６は、上記２次元マップ作成部２５で演算した２次元マップに基づき、自車両１の走行方向に狭路がある際に自車両１がこの狭路に進入する場合の理想の経路を演算する理想経路演算手段として形成されており、この理想経路演算部２６で求めた理想経路は上記報知制御部２８に出力されるようになっている。

【００３８】例えば、図８（ａ）に示すように、自車両１の前方に障害物としての駐車車両Ｈ1 と駐車車両Ｈ2 で形成される狭路ＳＰ（駐車車両Ｈ1 の左側最外縁部の接線・直線Ｌ1 と駐車車両Ｈ2 の右側最外縁部の接線・直線Ｌ2 との間）が有り、この狭路ＳＰに進入するための理想の経路を演算する場合は、上記２次元マップ作成部２５から車両周辺の情報として図８（ｂ）に示すような２次元マップが入力される。

【００３９】そして、図８（ｃ）に示すように、この２次元マップ上で直線Ｌ2 よりも狭路ＳＰ側に予め設定しておいたマージンを持たせた直線Ｌ3 を引き、駐車車両Ｈ1，Ｈ2 の自車両１側の直線との交点をＰｔ1とし、電柱Ｈ3 の周囲に一定の幅でマージンを持たせ、自車両１側との接触の可能性の最も高い点をＰｔ2とする。

【００４０】この点Ｐｔ2を原点とし、狭路ＳＰを進む方向にｙ軸の正方向を取った座標系で、ｘ＝－ｋ１・tanh（ｋ２・ｙ）、（ｋ１は１程度）が直線Ｌ3 を漸近線として点Ｐｔ1付近でほぼ直線Ｌ3 に沿うように設定する。この式で出来た曲線Ｌ4 を自車両１の左側最外縁が通る理想的な軌道として右側の軌道も求めるのである。

【００４１】上記予想位置推定部２７は、予想位置推定手段としてのもので、前記車速センサ５からの車両速度、前記ハンドル角センサ６からのハンドル角、上記２次元マップ作成部２５からの２次元マップに基づき、この２次元マップ上で自車両１がこのままの運転状態を維持した場合の設定時間後（例えば、２秒後）の予想位置を、自車両１の車両諸元で予め設定しておいた車両の運動方程式等により求めて予想するようになっており、求めた予想位置は上記報知制御部２８に出力されるようになっている。

【００４２】上記報知制御部２８は、上記理想経路演算部２６で求めた理想経路と上記予想位置推定部２７で求めた予想位置とを合成し、上記２次元マップ作成部２５で作成した２次元マップ上に共に表示させるように、前記車室内に設けたモニタ等の状態表示部８に信号出力するように形成されており、上記報知制御部２８とこの状態表示部８とで報知手段が形成されている。このため運転者は状態表示部８を視ることにより、障害物の回避の

可能性を容易に認識できるとともに、これから行うべき運転操作も素早く容易に認識でき、また気付いていない障害物情報も知ることができるようになっている。

【００４３】次に、上記構成による車両用運転支援装置の作用について、図３のフローチャートを基に説明する。プログラムがスタートすると、まず、ステップ（以下「Ｓ」と略称）１０１で、車速センサ５により自車両１の速度Ｖを、ハンドル角センサ６により自車両１のハンドル角θを検出して読み込むとともに、左右のＣＣＤカメラ３で自車両１の走行方向の環境を撮像して制御装置４の画像認識部２１に取り込む。この１組のステレオ画像対は、上記画像認識部２１で、対応する位置のずれ量から三角測量の原理によって画像全体に渡る距離情報を求める処理が行なわれ、三次元の距離分布を表す距離画像が生成されて道路形状・障害物認識部２２に出力される。そして、この道路形状・障害物認識部２２で、上記画像認識部２１からの距離画像の距離分布についてヒストグラム処理を行うことで道路・障害物等の立体物等を認識し、自車両１から見た立体物の相対位置座標（相対位置情報）の計算が行なわれて、上記狭路判定処理部２３と上記２次元マップ作成部２５に出力される（すなわち、道路・障害物情報の読み込みが行われる）。

【００４４】その後、Ｓ１０２に進み、進行方向（自車両１の走行方向の略正面の設定範囲内）に狭路が有るか否かの判定が行われる。そして、走行方向で極低速または静止している車両、道路端部のガードレール、縁石、家屋の塀等の障害物の間隔を計測して道路等の実質的な道幅Ｄを検出し、道幅Ｄと自車両１の車体の最大幅Ｗ及び余裕分との関係で、例えば車体の最大幅Ｗに４０cmの余裕分を加算した値より小さく、車体の最大幅Ｗに１０cmの余裕分を加算した値以上（Ｗ＋１０≦Ｄ＜Ｗ＋４０）の道幅Ｄを狭路として、狭路無しの場合（Ｗ＋１０＞ＤまたはＤ≧Ｗ＋４０の場合）はＳ１０３に進む。

【００４５】上記Ｓ１０３では、さらに上記通路（狭路ではない通路）が通行可能な通路であるか否かの判定を行い、走行するのに十分な余裕がある通路、すなわち、Ｄ≧Ｗ＋４０の通路の場合は上記Ｓ１０１に戻り、通行不可能な通路、すなわち、Ｗ＋１０＞Ｄの通路の場合はＳ１０４へと進む。尚、上記Ｓ１０２、Ｓ１０３は、狭路判定処理部２３で行われる処理である。

【００４６】上記Ｓ１０４に進むと、警報制御部２４が、運転者に対して通行不可能の注意をすべく、ブザー等の警報器７から警報音を発する。この場合の警報音も、障害物に近いほど音量が大きく、また間欠して行っていた警報間隔も短くなるようにして効果的に運転者に報知する。さらに、明らかに障害物との衝突が避けられない場合、自動ブレーキ装置（図示せず）が作動される。そして、このＳ１０４の処理の後、プログラムを抜ける。

【００４７】一方、上記Ｓ１０２で自車両１の進行方向に狭路が有る場合（Ｗ＋１０≦Ｄ＜Ｗ＋４０の場合）はＳ１０５へ進む。このＳ１０５に進むと、上記２次元マップ作成部２５で、後述する２次元マップ作成ルーチンに従って、ハンドル角θと車両速度Ｖと相対位置情報（道路・障害物情報）を基に、過去（前回）に作成した環境位置情報（２次元マップ）を次々に更新して、自車両１の走行方向を含む自車両１周辺の環境の２次元マップを形成する。

【００４８】その後、Ｓ１０６へ進み、理想経路演算部２６で、上記２次元マップ作成部２５で演算した２次元マップに基づき、自車両１の走行方向に狭路がある際に自車両１がこの狭路に進入する場合の理想の経路を演算する。

【００４９】次いで、Ｓ１０７へ進み、予想位置推定部２７で、ハンドル角θ、車両速度Ｖ、２次元マップに基づき、この２次元マップ上で自車両１がこのままの運転状態を維持した場合の設定時間後（例えば、２秒後）の予想位置を、自車両１の車両諸元で予め設定しておいた車両の運動方程式等により求めて予想する。

【００５０】そして、Ｓ１０８へ進んで、報知制御部２８は、車室内に設けたモニタ等の状態表示部８に信号出力し、上記理想経路演算部２６で求めた理想経路と上記予想位置推定部２７で求めた予想位置とを合成し、図９に示すように上記２次元マップ作成部２５で作成した２次元マップ上に共に表示させてプログラムを抜ける。

【００５１】このため運転者は状態表示部８を視ることにより、障害物の回避の可能性を容易に認識できるとともに、これから行うべき運転操作も素早く容易に認識でき、また気付いていない障害物情報も知ることができる。

【００５２】次に、図４は２次元マップ作成部２５で実行される２次元マップ作成ルーチンのフローチャートを示し、このルーチンがスタートされると、まず、Ｓ２０１でハンドル角θによる実舵角δ、車両移動量ΔＭ（車速と計測時間から演算）、前回の２次元マップを読み込み、その後、Ｓ２０２に進んで実舵角δの値から旋回状態か直進状態かを判定し、直進状態の場合にはＳ２０３に進み、旋回状態の場合にはＳ２０４に進む。

【００５３】上記Ｓ２０２で直進状態と判定してＳ２０３に進むと、前回の２次元マップに車両移動量ΔＭを加算して（前記（１）式，（２）式に基づく処理を行なって）、Ｓ２０６に進む。

【００５４】一方、上記Ｓ２０２で旋回状態と判定してＳ２０４に進むと、実舵角δ、車両移動量ΔＭから旋回中心ＰＣ、旋回角θｃを算出し（前記（３）式，（４）式，（５）式に基づく算出）、Ｓ２０５に進んで前回の２次元マップを上記旋回中心ＰＣを中心に旋回角θｃ回転させ（前記（６）式，（７）式に基づく処理を行なって）、Ｓ２０６に進む。

【００５５】上記Ｓ２０３あるいは上記Ｓ２０５からＳ

２０６に進むと、前回の２次元マップの中で、上記Ｓ２０３あるいは上記Ｓ２０５の処理により記憶領域外に出たもののデータの消去を行なう。

【００５６】次いで、Ｓ２０７に進み、前回の２次元マップの中で、上記Ｓ２０３あるいは上記Ｓ２０５の処理により立体物の新たな相対位置情報と重複するデータを消去する。

【００５７】次に、Ｓ２０８に進み、自車両１から見た立体物の相対位置座標（相対位置情報）を読み込み、Ｓ２０９に進んで、上記Ｓ２０７で形成した前回の２次元マップに上記新たな相対位置情報を加え記憶する。この立体物位置情報が今回更新された新たな２次元マップである。

【００５８】尚、記憶された今回の新たな２次元マップは、次回制御プログラムが実行される際には、前回の２次元マップとして読み込まれ処理される。この様に２次元マップを作成するようになっているため、一旦車両前方で認識された立体物が車両の移動に伴って車両側方になってしまった場合でもその位置を把握することができ、車両前方に存在する障害物に対する運転支援はもちろん、車両側方に存在する障害物に対する運転支援も容易に行なうことが可能である。

【００５９】以上のように本発明の実施の第１形態によれば、駐車させる場合以外の様々な状況に対応して、走行する方向に例えどんな障害物があっても、これを運転者に報知して、運転者が容易に素早く的確な判断を行って障害物との接触を回避し、狭路走行ができるようにガイドする確実で信頼性、実用性の高いものとなる。

【００６０】次に、図１０～図１３は本発明の実施の第２形態に係わり、図１０は車両用運転支援装置の機能ブロック図、図１１は車両用運転支援装置の概略構成図、図１２は狭路ガイド制御のフローチャート、図１３はモニタへの表示の一例を示す説明図である。尚、本発明の実施の第２形態は、理想経路演算部で演算した理想経路と予想位置推定部で推定した自車両の予想位置とを表示するとともに、上記理想経路と上記予想位置とに基づき自車両の上記予想位置の上記理想経路からの外れ量を演算し、この外れ量を最小にする速度修正量と舵角修正量とを演算してこれらを所定に表示する一方、上記速度修正量と上記舵角修正量とを自車両の走行状態に応じて可変して所定に音声出力し、狭路走行をガイドするようにしたものである。

【００６１】図１０において、符号４１は車両用運転支援装置を示し、この車両用運転支援装置は１組のＣＣＤカメラ３で撮像した自車両１の走行方向の映像信号が、制御装置４２に入力されるようになっている。

【００６２】また、上記車両用運転支援装置４１は、走行状態検出手段として、前記発明の実施の第１形態と同様、車速センサ５、ハンドル角センサ６からの各検出信号が上記制御装置４２に入力されるように形成されており、上記制御装置４２は上述の各情報に基づいて狭路進入の可否の判定や、障害物との接触防止を図って狭路の走行をガイドする機能を達成すべく、警報器７、状態表示部８、操作ガイド表示部４３、左音声出力部４４Ｌ、右音声出力部４４Ｒに制御出力するように構成されている。

【００６３】上記操作ガイド表示部４３は、上記制御装置４２からの出力信号（後述する舵角修正量と速度修正量）に応じて、車内に設けたモニタ等に、例えば図１３に示すように、上記状態表示部８とともに表示され（Ａｐのエリア）、ハンドル角をどの程度修正すれば良いか（APHのエリア）、車速をどの程度修正すれば良いか（APVのエリア）を視覚的に表示するようになっている。

【００６４】また、上記左右の音声出力部４４Ｌ，４４Ｒは、上記制御装置４２からの出力信号（上記舵角修正量と速度修正量）に応じて、予め記録媒体に記録しておいた音声信号を用いて、左への指示ならば上記左音声出力部４４Ｌを作動させて例えば「左方向へ少しハンドルを回して下さい」と音声出力する一方、右への指示ならば上記右音声出力部４４Ｒを作動させて例えば「右方向へ少しハンドルを回して下さい」と音声出力するようになっている（速度のみ可変指示の場合は上記左右の音声出力部４４Ｌ，４４Ｒ両方から行う）。

【００６５】ここで、上記左右の音声出力部４４Ｌ，４４Ｒから音声出力するタイミングは、上記制御装置４２により、予め現在の車速や加速度によって変化させられるようになっている。例えば、現在の車速は低くても加速中ならば早めの音声出力を発し、減速中ならば遅めに音声出力を発するようになっている。

【００６６】上記制御装置４２は、マイクロコンピュータとその周辺回路で形成され、図１０に示すように、画像認識部２１、道路形状・障害物認識部２２、狭路判定処理部２３、警報制御部２４、２次元マップ作成部２５、理想経路演算部２６、予想位置推定部２７、報知制御部４５で主に構成されている。

【００６７】上記報知制御部４５は、上記理想経路演算部２６で求めた理想経路と上記予想位置推定部２７で求めた予想位置とを合成し、上記２次元マップ作成部２５で作成した２次元マップ上に共に表示させるように、前記車室内に設けたモニタ等の状態表示部８に信号出力するように形成される。また、上記報知制御部４５は、上記理想経路と上記予想位置とに基づき自車両１の上記予想位置の上記理想経路からの外れ量を演算し、この外れ量を最小にする速度修正量と舵角修正量とを車両諸元に基づき演算して、これらを上記操作ガイド表示部４３に出力するとともに、上記速度修正量と上記舵角修正量とを自車両の走行状態（現在の速度、加速度）に応じて発生タイミングを可変して上記左右の音声出力部４４Ｌ，４４Ｒに信号出力するようになっている。すなわち、上

記報知制御部４５、状態表示部８、操作ガイド表示部４３、左右の音声出力部４４Ｌ，４４Ｒで報知手段が形成されている。

【００６８】このような構成で本発明の実施の第２形態では、図１２のフローチャートに示すようにプログラムが実行される。本発明の実施の第２形態は、Ｓ１０１～Ｓ１０７まで前記発明の実施の第１形態と同様の処理が行われ、上記Ｓ１０７で、ハンドル角θ、車両速度Ｖ、２次元マップに基づき、この２次元マップ上で自車両１がこのままの運転状態を維持した場合の設定時間後の予想位置を、自車両１の車両諸元で予め設定しておいた車両の運動方程式等により求めて予想した後、Ｓ３０１へ進む。

【００６９】上記Ｓ３０１では、報知制御部４５で上記理想経路と上記予想位置とに基づき自車両１の上記予想位置の上記理想経路からの外れ量を演算し、この外れ量を最小にする速度修正量と舵角修正量とを車両諸元に基づき演算する。

【００７０】そして、Ｓ３０２へ進み、上記報知制御部４５は、上記理想経路と上記予想位置とを合成し、２次元マップ上に共に表示させるように、車室内に設けたモニタ等の状態表示部８に信号出力するとともに、上記速度修正量と上記舵角修正量を操作ガイド表示部４３に出力して表示させる一方、上記速度修正量と上記舵角修正量を自車両の走行状態（現在の速度、加速度）に応じて発生タイミングを可変して上記左右の音声出力部４４Ｌ，４４Ｒに信号出力して音声出力させ走行ガイドする。

【００７１】このように本発明の実施の第２形態では、前記第１形態での効果に加え、速度修正量と舵角修正量とを演算してこれらを所定に表示することで、運転者はこれから行うべき速度修正量と舵角修正量を視認して、これから行うべき運転操作をより素早く容易に認識できるようになっている。

【００７２】また、速度修正量と舵角修正量は音声出力されるので、運転者が障害物位置を車内の表示等を視認して確認することができなくても確実に上記理想経路に沿うようにガイドされる。そしてこの音声出力のタイミングも自車両の走行状態に応じて可変して行なわれるため、車両速度、加速度等のパラメータにより適切な時期に音声ガイドされて運転操作が一層容易になる。

【００７３】尚、上記各発明の実施の形態では、走行状態検出手段として車速センサとハンドル角センサを設けた例で説明しているが、他のセンサをさらに付加して制御するようにしても良い。例えばヨーレートセンサ等を＊＊設けてヨーレートを制御パラメータとしても良い。

【００７４】

【発明の効果】以上説明したように本発明によれば、走行する方向に例えどんな障害物があっても、これを運転者に報知して、運転者が容易に素早く的確な判断を行って障害物との接触を回避して狭路走行ができるようにガイドされ、確実で信頼性、実用性が高いという優れた効果を奏する。

【図面の簡単な説明】

【図１】本発明の実施の第１形態に係わり、車両用運転支援装置の機能ブロック図

【図２】同上、車両用運転支援装置の概略構成図

【図３】同上、狭路ガイド制御のフローチャート

【図４】同上、２次元マップ作成ルーチンのフローチャート

【図５】同上、狭路判定の範囲の説明図

【図６】同上、車両周辺の立体物位置情報の説明図

【図７】同上、前回の立体物位置情報を移動させる際の説明図

【図８】同上、車両前方の狭路に理想経路を設定する一例を示す説明図

【図９】同上、モニタへの表示の一例を示す説明図

【図１０】本発明の実施の第２形態に係わり、車両用運転支援装置の機能ブロック図

【図１１】同上、車両用運転支援装置の概略構成図

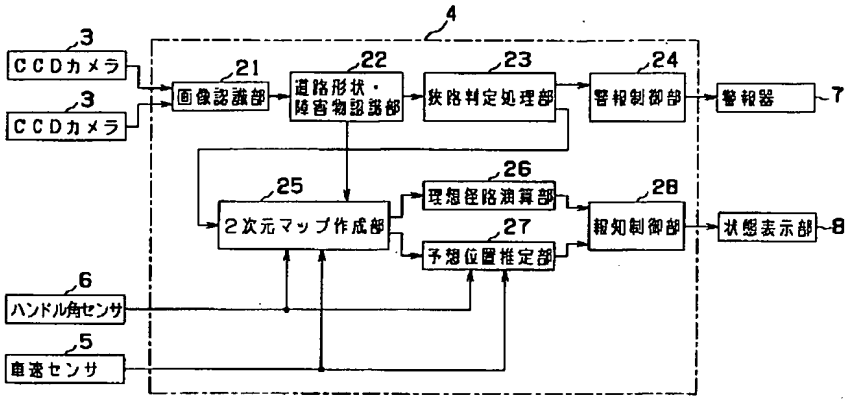
【図１２】同上、狭路ガイド制御のフローチャート

【図１３】同上、モニタへの表示の一例を示す説明図

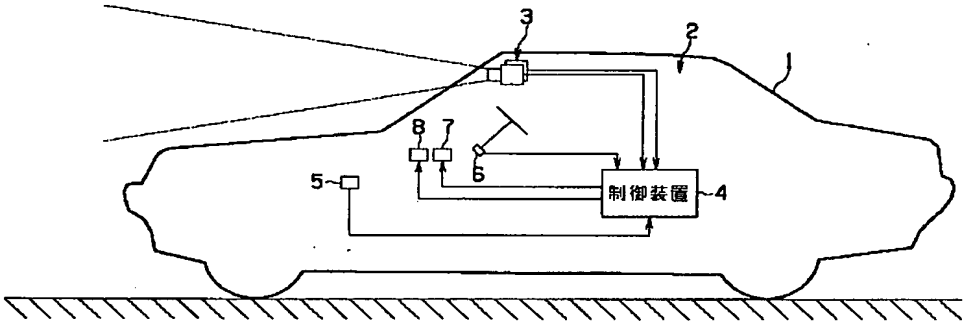
【符号の説明】

１　自車両
２　車両用運転支援装置
３　ＣＣＤカメラ（走行環境検出手段）
４　制御装置
５　車速センサ（走行状態検出手段）
６　ハンドル角センサ（走行状態検出手段）
７　警報器
８　状態表示部（報知手段）
２１　画像認識部（走行環境検出手段）
２２　道路形状・障害物認識部（走行環境検出手段）
２３　狭路判定処理部
２４　警報制御部
２５　２次元マップ作成部（環境位置情報形成手段）
２６　理想経路演算部（理想経路演算手段）
２７　予想位置推定部（予想位置推定手段）
２８　報知制御部（報知手段）

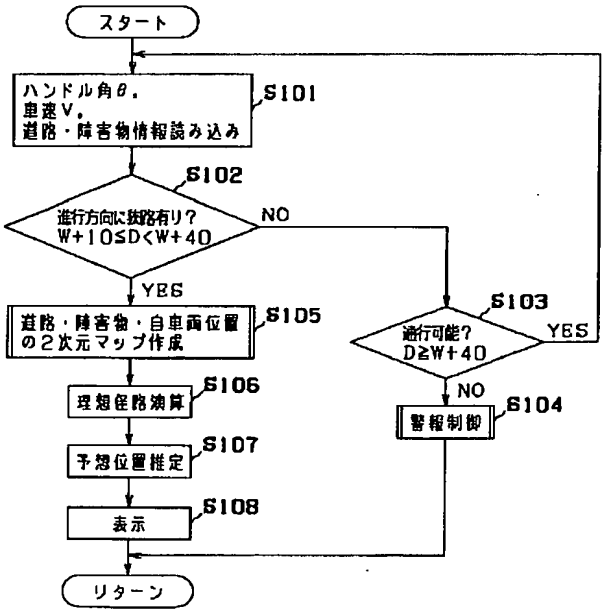
【図１】


4
3
CCDカメラ
3
CCDカメラ
21
画像認識部
22
道路形状・
障害物認識部
23
狭路判定処理部
24
警報制御部
警報器
7
25
2次元マップ作成部
26
理想径路演算部
27
予想位置推定部
28
報知制御部
状態表示部
8
6
ハンドル角センサ
5
車速センサ

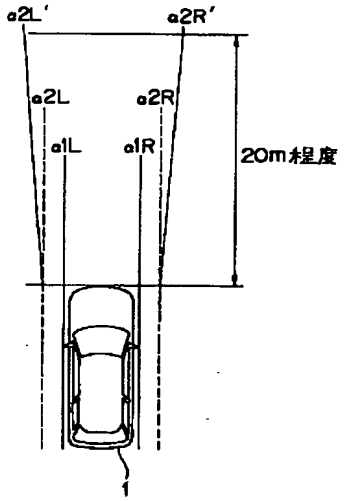
【図２】


3
2
1
8
7
6
5
制御装置
4

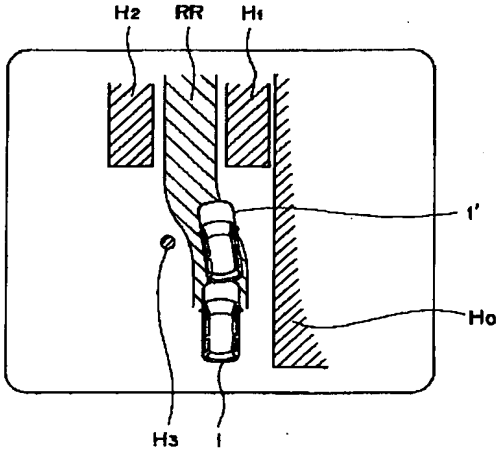
【図３】


スタート
ハンドル角θ,
車速V,
道路・障害物情報読み込み
S101
S102
進行方向に狭路有り?
W+10≦D<W+40
NO
YES
S103
通行可能?
D≧W+40
YES
NO
S104
警報制御
S105
道路・障害物・自車両位置
の2次元マップ作成
S106
理想径路演算
S107
予想位置推定
S108
表示
リターン

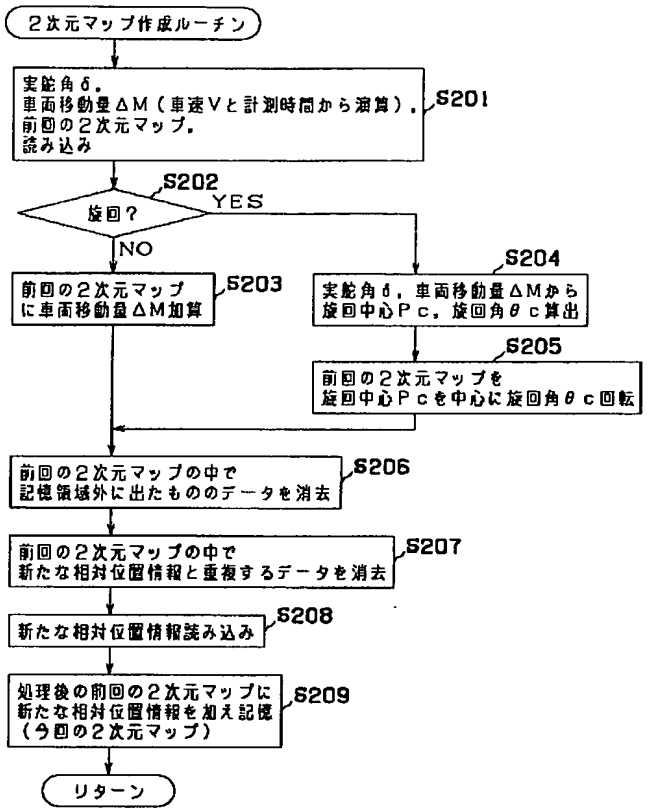
【図５】


α2L'
α2R'
α2L
α2R
α1L
α1R
20m程度
1

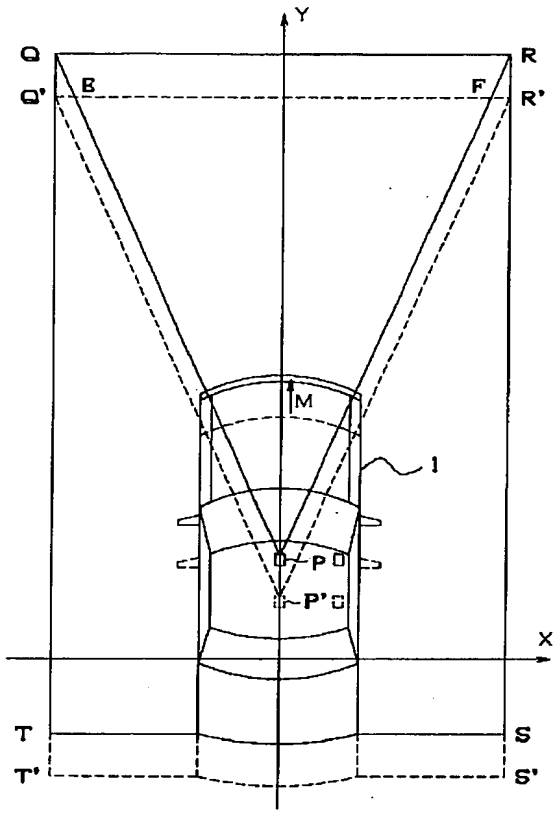
【図９】


H2
RR
H1
1'
Ho
H3
1

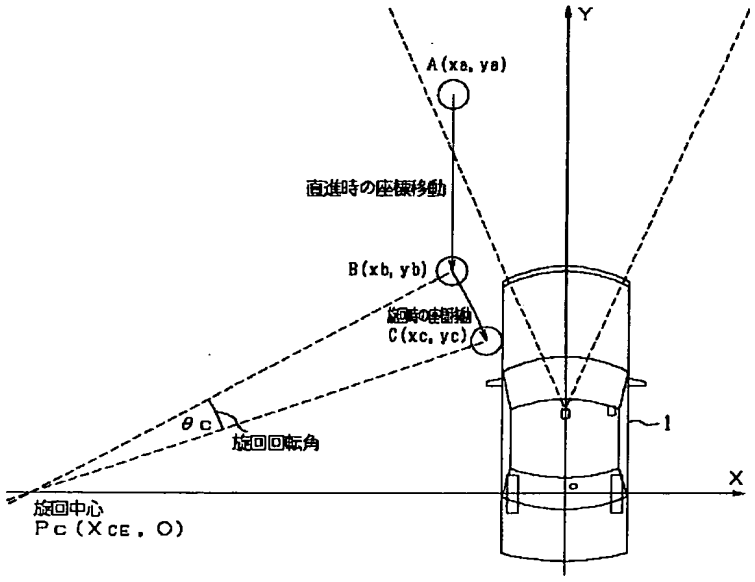
【図４】


２次元マップ作成ルーチン
実舵角δ，
車両移動量ΔM（車速Vと計測時間から演算），
前回の２次元マップ，
読み込み
S201
旋回？
S202
YES
NO
前回の２次元マップ
に車両移動量ΔM加算
S203
実舵角δ，車両移動量ΔMから
旋回中心Ｐｃ，旋回角θｃ算出
S204
前回の２次元マップを
旋回中心Ｐｃを中心に旋回角θｃ回転
S205
前回の２次元マップの中で
記憶領域外に出たもののデータを消去
S206
前回の２次元マップの中で
新たな相対位置情報と重複するデータを消去
S207
新たな相対位置情報読み込み
S208
処理後の前回の２次元マップに
新たな相対位置情報を加え記憶
（今回の２次元マップ）
S209
リターン

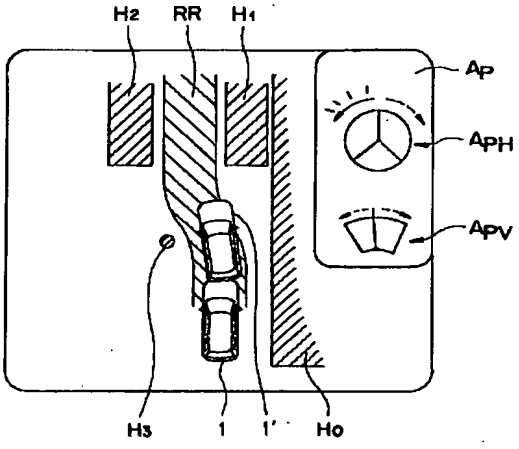
【図６】


Y
Q
Q'
R
R'
B
F
M
1
P
P'
X
T
T'
S
S'

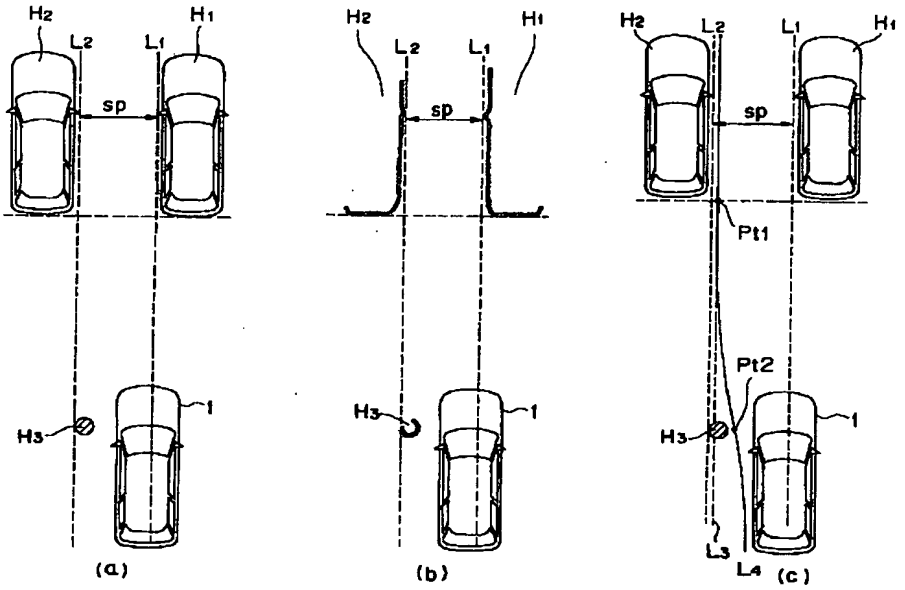
【図７】


Y
A(xa, ya)
直進時の座標移動
B(xb, yb)
旋回時の後輪軸
C(xc, yc)
θc
旋回回転角
1
X
旋回中心
Pc（Xce，O）

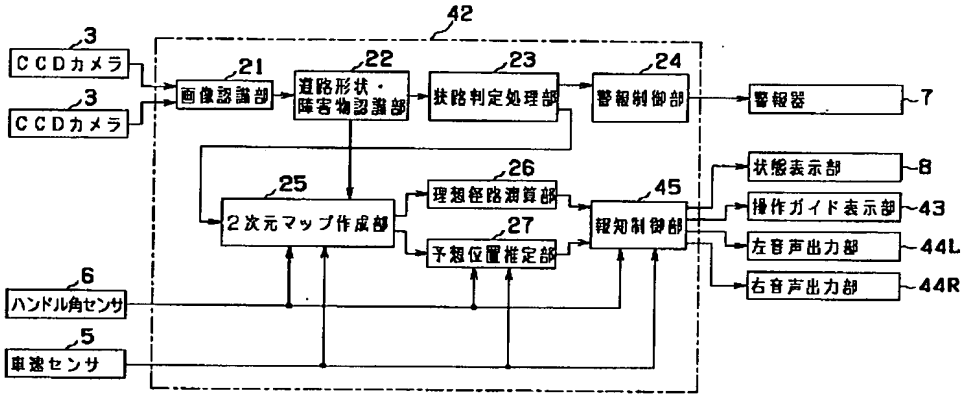
【図１３】


H2
RR
H1
AP
APH
APV
H3
1
1'
Ho

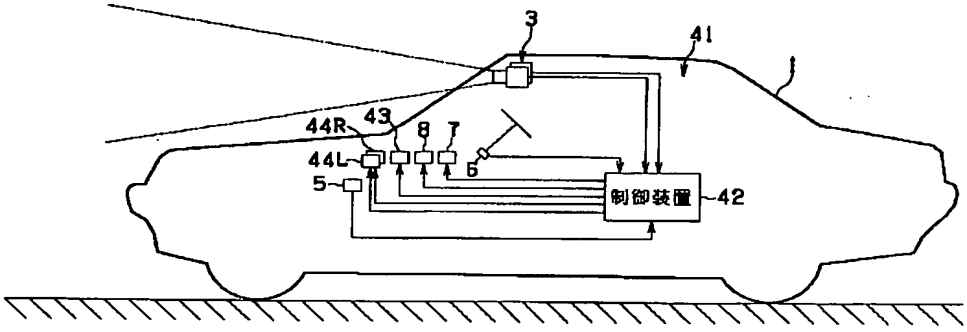
【図８】


H2
L2
L1
H1
sp
H3
1
(a)
(b)
Pt1
Pt2
L3
L4
(c)

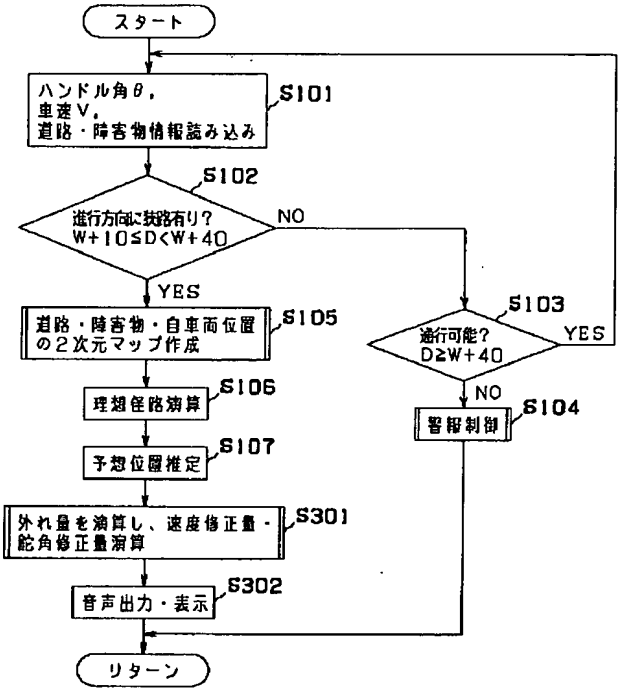
【図１０】


42
3
CCDカメラ
3
CCDカメラ
21
画像認識部
22
道路形状・
障害物認識部
23
状況判定処理部
24
警報制御部
警報器
7
25
2次元マップ作成部
26
理想経路演算部
27
予想位置推定部
45
報知制御部
状態表示部
8
操作ガイド表示部
43
左音声出力部
44L
右音声出力部
44R
6
ハンドル角センサ
5
車速センサ

【図１１】


3
41
44R
43
8
7
44L
6
5
制御装置
42

【図１２】

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# PATENT ABSTRACTS OF JAPAN

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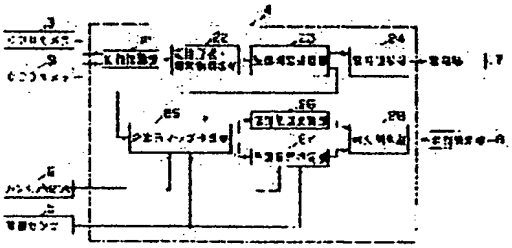
(71)Applicant : FUJI HEAVY IND LTD

(72)Inventor : IKEDA ATSUSHI
KINOSHITA MASAHIRO

(54) OPERATION SUPPORTING DEVICE FOR VEHICLE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a certain, reliable, and practical operation supporting device in which a driver can travel in a narrow road by evading contact with an obstacle by easily and quickly making accurate judgment.



SOLUTION: A speed V and a handle angle 9 are detected, the environment of a traveling direction is image picked-up by a CCD camera 3, and the calculation of relative position information is operated by a picture recognizing part 21 and a road shape and obstacle recognizing part 22. When a narrow road is present in the direction of travel according to judgment by a narrow road judgment processing part 23, second-dimensional maps

prepared in the past are successively updated, and the second-dimensional map of environment in the surrounding of a vehicle including the direction of travel is prepared by a second-dimensional map preparing part 25. Afterwards, an ideal path when the vehicle is intruding into the narrow road is calculated based on the second-dimensional map by an ideal path calculating part 26, and an expected position after the set time of a vehicle 1 is expected on the second-dimensional map by an expected position estimating part 27. Then, an announcement controlling part 28 outputs a signal to a state display part 8, and the ideal path is synthesized with the expected position and displayed on the second-dimensional map.

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LEGAL STATUS

[Date of request for examination]

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[Date of registration]

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[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

## CLAIMS

[Claim(s)]

[Claim 1] Operation support equipment for vehicles characterized by providing the following. A run state detection means to detect a self-rolling-stock-run state. A run environmental detection means to detect the passage configuration and solid object of the above-mentioned self-rolling-stock-run direction. Environmental positional information means forming which forms the positional information of the above-mentioned run state, the above-mentioned passage configuration, and the environment of the above-mentioned self-vehicles circumference that includes the above-mentioned self-rolling-stock-run direction based on the above-mentioned solid object information. An ideal path operation means to calculate the path of an ideal in which the above-mentioned self-vehicles advance into this narrow road in case there is a narrow road in the above-mentioned self-rolling-stock-run direction, A future-position presumption means to presume the future position of the above-mentioned self-vehicles after the setup time based on the above-mentioned run state of the above-mentioned self-vehicles, An information means to guide a narrow road run of the above-mentioned self-vehicles based on the future position of the above-mentioned self-vehicles presumed with the positional information of the environment of the above-mentioned self-vehicles circumference formed by the above-mentioned environmental positional information means forming, the above-mentioned ideal path calculated with the above-mentioned ideal path operation means, and the above-mentioned future-position presumption means.

[Claim 2] The above-mentioned information means is operation support equipment for vehicles according to claim 1 characterized by displaying the future position of the above-mentioned self-vehicles presumed with the above-mentioned ideal path and the above-mentioned future-position presumption means which were calculated with the above-mentioned ideal path operation means on the positional information of the environment of the above-mentioned self-vehicles circumference formed by the above-mentioned environmental positional information means forming.

[Claim 3] It is operation support equipment according to claim 1 or 2 for vehicles which carries out [ that the above-mentioned information means calculates the amount of speed corrections and the amount of rudder-angle corrections which make this amount of blanks the minimum, and displays them on predetermined while it calculates the amount of blanks from the above-mentioned ideal path of the above-mentioned future

position of the above-mentioned self-vehicles based on the above-mentioned future position which presumed with the above-mentioned ideal path and the above-mentioned future-position presumption means which calculated with the above-mentioned ideal path operation means, and ] as the feature.

[Claim 4] While the above-mentioned information means calculates the amount of blanks from the above-mentioned ideal path of the above-mentioned future position of the above-mentioned self-vehicles based on the above-mentioned future position presumed with the above-mentioned ideal path and the above-mentioned future-position presumption means which were calculated with the above-mentioned ideal path operation means The claims 1 and 2, operation support equipment for vehicles of any one publication of three which calculate the amount of speed corrections and the amount of rudder angle corrections which make this amount of blanks the minimum, carry out a voice output to predetermined, and are characterized by guiding a narrow road run.

[Claim 5] The above-mentioned information means is operation support equipment for vehicles according to claim 4 characterized by carrying out by carrying out adjustable [ of the timing of the above-mentioned voice output ] according to the above-mentioned self-rolling-stock-run state.

## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the operation support equipment for vehicles which supports operation of a driver so that the exact information about the possibility of contact with obstructions, such as a guard rail, a side attachment wall, and parking vehicles, may be offered and the penetration and the run to a narrow road etc. can be performed easily.

[0002]

[Description of the Prior Art] In order to aim at improvement in the safety of vehicles in recent years, the synthetic operation aide (ADA;Active Drive Assist system) which supports the operation of a driver positively is developed. This ADA system presumes various possibility, such as a collision with precedence vehicles, contact with an obstruction, and lane deviation, from rolling-stock-run environmental information or a self-rolling-stock-run state, and when it is predicted that safety is unmaintainable, it performs information, other control, etc. to a driver.

[0003] As equipment for obtaining the above-mentioned rolling-stock-run environmental information, although laser radar equipment etc. is better known than before, recently, it is becoming possible to process the scenery ahead of vehicles and the objective image information which were caught with two or more cameras carried in vehicles, and to recognize a passage and traffic environment in three dimensions in a practically sufficient precision and practically sufficient time.

[0004] A parking auxiliary device is as a thing using the narrow road guide function which aims at the judgment of the propriety of the narrow road penetration which is one of the functions of the above-mentioned ADA system, and contact prevention with an obstruction, and guides a run of a narrow road, for example parking space determines to JP,6-234341,A, and the technology carry out voice directions efficiently that self-vehicles should guide to a parking position along the TWY which calculated based on physical relationship with a parking position and the current position is shown.

[0005]

[Problem(s) to be Solved by the Invention] However, in order to calculate based on physical relationship with a parking position and the current position, when obstructions, such as a telegraph pole and a curbstone, exist in before a parking position, the correspondence is difficult for the TWY of the above-mentioned advanced technology.

[0006] Namely, no matter it may be formed in the direction it runs in consideration of there being various obstructions, it may compare and there may be what obstruction, an operator avoids this effectively and needs to enable it to run this easily in the narrow road guide which must be made to correspond to various situations of an except when making a car park.

[0007] No matter what obstruction this invention might be made in view of the above-mentioned situation, and it may compare it in the direction it runs and it may have, this is reported to an operator, and it is certain and aims at the thing which guide so that an operator may make a quick adequate judgment easily, contact with an obstruction may be avoided and a narrow road run can be performed and for which the high operation support equipment for vehicles of reliability and practicality is offered.

[0008]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the operation support equipment for vehicles by this invention according to claim 1 A run state detection means to detect a self-rolling-stock-run state, and the passage configuration of the above-mentioned self-rolling-stock-run direction and a run environmental detection means to detect a solid object, The above-mentioned run state, the above-mentioned passage configuration, and the environmental positional information means forming that forms the positional information of the environment of the above-mentioned self-vehicles circumference which includes the above-mentioned self-rolling-stock-run direction based on the above-mentioned solid object information, An ideal path operation means to calculate the path of an ideal in which the above-mentioned self-vehicles advance into this narrow road in case there is a narrow road in the above-mentioned self-rolling-stock-run direction, A future-position presumption means to presume the future position of the above-mentioned self-vehicles after the setup time based on the above-mentioned run state of the above-mentioned self-vehicles, It has an information means to guide a narrow road run of the above-mentioned self-vehicles based on the future position of the above-mentioned self-vehicles presumed with the positional information of the environment of the above-mentioned self-vehicles circumference formed by the above-mentioned environmental positional information means forming, the above-mentioned ideal path calculated with the above-mentioned ideal path operation means, and the above-mentioned future-position presumption means.

[0009] The operation support equipment of the claim 1 above-mentioned publication for vehicles forms the positional information of the environment of the above-mentioned self-vehicles circumference which detects a self-rolling-stock-run state with a run state

detection means, detects the passage configuration and the solid object of the above-mentioned self-rolling-stock-run direction with a run environmental detection means, and includes the above-mentioned self-rolling-stock-run direction based on the above-mentioned run state, the above-mentioned passage configuration, and the above-mentioned solid object information by environmental positional information means forming. And the path of an ideal in which the above-mentioned self-vehicles advance into this narrow road in case there is a narrow road in the above-mentioned self-rolling-stock-run direction with an ideal path operation means is calculated. Based on the above-mentioned run state of the above-mentioned self-vehicles, the future position of the above-mentioned self-vehicles after the setup time is presumed with a future-position presumption means. Based on the future position of the above-mentioned self-vehicles presumed with the positional information of the environment of the above-mentioned self-vehicles circumference formed by the above-mentioned environmental positional information means forming, the above-mentioned ideal path calculated with the above-mentioned ideal path operation means, and the above-mentioned future-position presumption means, a narrow road run of the above-mentioned self-vehicles is guided with an information means.

[0010] Moreover, the operation support equipment for vehicles by this invention according to claim 2 In the operation support equipment for vehicles according to claim 1 the above-mentioned information means It is what displays the future position of the above-mentioned self-vehicles presumed with the above-mentioned ideal path and the above-mentioned future-position presumption means which were calculated with the above-mentioned ideal path operation means on the positional information of the environment of the above-mentioned self-vehicles circumference formed by the above-mentioned environmental positional information means forming. While an operator can recognize the possibility of evasion of an obstruction easily by checking by looking the future position of the above-mentioned ideal path displayed on the environmental positional information of the above-mentioned self-vehicles circumference, and the above-mentioned self-vehicles The operation which should be performed from now on, and the obstruction information which can recognize easily quickly and has not been noticed can be known.

[0011] Furthermore, the operation support equipment for vehicles by this invention according to claim 3 In the operation support equipment for vehicles according to claim 1 or 2 the above-mentioned information means While calculating the amount of blanks from the above-mentioned ideal path of the above-mentioned future position of the above-mentioned self-vehicles based on the above-mentioned future position presumed

with the above-mentioned ideal path and the above-mentioned future-position presumption means which were calculated with the above-mentioned ideal path operation means The amount of speed corrections and the amount of rudder angle corrections which make this amount of blanks the minimum are calculated, and it displays on predetermined, and an operator checks by looking the amount of speed corrections and the amount of rudder angle corrections which should be performed from now on, and can recognize more quickly the operation which should be performed from now on easily.

[0012] Moreover, the operation support equipment for vehicles by this invention according to claim 4 In claims 1 and 2 and the operation support equipment for vehicles of any one publication of three the above-mentioned information means While calculating the amount of blanks from the above-mentioned ideal path of the above-mentioned future position of the above-mentioned self-vehicles based on the above-mentioned future position presumed with the above-mentioned ideal path and the above-mentioned future-position presumption means which were calculated with the above-mentioned ideal path operation means The amount of speed corrections and the amount of rudder angle corrections which make this amount of blanks the minimum are calculated, a voice output is carried out to predetermined, a narrow road run is guided, and even if an operator cannot check a display in the car etc. by looking and cannot check an obstruction position, he is guided in it so that the above-mentioned ideal path may certainly be met.

[0013] Furthermore, in the operation support equipment for vehicles according to claim 4, the above-mentioned information means carries out adjustable [ of the timing of the above-mentioned voice output ] according to the above-mentioned self-rolling-stock-run state, the operation support equipment for vehicles by this invention according to claim 5 performs it, a voice guide is carried out with parameters, such as vehicles speed and acceleration, at a suitable stage, and operation becomes still easier.

[0014]

[Embodiments of the Invention] Hereafter, the gestalt of operation of this invention is explained based on a drawing. Drawing 1 - drawing 9 are involved in the 1st gestalt of operation of this invention. drawing 1 The functional block diagram of the operation support equipment for vehicles, The outline block diagram of the operation support equipment for vehicles and drawing 3 drawing 2 The flow chart of narrow road guide control, The flow chart of a two-dimensional map generating routine and drawing 5 drawing 4 Explanatory drawing of the range of a narrow road judging. Explanatory drawing at the time of drawing 6 moving explanatory drawing of the solid object

positional information of the vehicles circumference. and drawing 7 moving the last solid object positional information. explanatory drawing showing an example with which drawing 8 sets an ideal path as the narrow road ahead of vehicles, and drawing 9 are explanatory drawings showing an example of the display to a monitor.

[0015] In drawing 2 , signs 1 are vehicles (self-vehicles), such as an automobile, it has the function to aim at judgment of the propriety of narrow road penetration. and contact prevention with an obstruction on these self-vehicles 1, as one function, and the operation support equipment 2 for vehicles which supports operation of a driver is carried. Hereafter, with the 1st gestalt of operation of this invention, only the judgment of the propriety of narrow road penetration of the operation support equipment 2 for vehicles and the portion of the function to aim at contact prevention with an obstruction are explained, and explanation is omitted about the portion of other functions.

[0016] The above-mentioned operation support equipment 2 for vehicles has 1 set of CCD cameras (right and left) 3 using solid state image pickup devices, such as a charge-coupled device (CCD), as stereo optical system, and CCD camera 3 of these right and left is attached ahead [ of the vehicle interior of a room / ceiling ] with a fixed interval, respectively, and carries out the stereo image pck-up of the object outside a vehicle from a different view. And the video signal of the run direction of the self-vehicles 1 picturized by the 1 above-mentioned set of CCD cameras 3 is inputted into a control unit 4.

[0017] Moreover, the above-mentioned operation support equipment 2 for vehicles is formed so that each signal from the vehicle speed sensor 5 which detects the speed of the above-mentioned self-vehicles 1, and the handle angle sensor 6 which detects a handle angle may be inputted into the above-mentioned control unit 4 as a run state detection means. The above-mentioned control unit 4 is based on each above-mentioned information (each signal from the video signal, the vehicle speed sensor 5, and the handle angle sensor 6 from CCD camera 3). The judgment of the propriety of narrow road penetration, That the function which aims at contact prevention with an obstruction and guides a run of a narrow road should be attained, it is constituted so that a control output may be carried out to an alarm 7 and the status-display section 8.

[0018] The above-mentioned alarm 7 is a buzzer etc., when run to the narrow road of the size whose penetration is impossible, or when there is possibility of contact with an obstruction when a run is continued, emits an alarm tone by the output signal from the above-mentioned control unit 4, and reports it to a driver.

[0019] Moreover, as shown in the monitor formed in in the car at drawing 9 according to the output signal from the above-mentioned control unit 4, the above-mentioned

status-display section 8 The physical relationship of the self-vehicles 1 and an obstruction (a wall H0, the parking vehicles H1, H2, and telegraph pole H3), It expresses as the two-dimensional map which looked at the ideal path RR for running future-position 1' after the setup time when the self-vehicles 1 maintain operational status with this (the handle angle θ, vehicles speed V) (for example, after 2 seconds), and a narrow road from the upper surface visually. By the case where it is shown in drawing 9 , it is blue, and in red, in the future position after the setup time, the ideal path RR is intelligibly displayed [ obstruction / each ] at color display, for example, as it is yellow.

[0020] The above-mentioned control unit 4 is formed in a microcomputer and its circumference circuit, and as shown in drawing 1 , it mainly consists of the image-recognition section 21, a passage configuration and the obstruction recognition section 22, the narrow road judging processing section 23, the alarm control section 24, the two-dimensional map creation section 25, ideal path operation part 26, the future-position presumption section 27, and an information control section 28.

[0021] The above-mentioned image-recognition section 21 performs processing which searches for the distance information over the whole picture by the principle of triangulation from the amount of gaps of a corresponding position to 1 set of stereo picture pairs of the environment of the run direction of the self-vehicles 1 picturized by above-mentioned CCD camera 3, and it is formed so that the depth map showing the distance distribution of three dimensions may be generated and it may output to above-mentioned passage configuration and obstruction recognition section 22.

[0022] Above-mentioned passage configuration and obstruction recognition section 22 recognize solid objects, such as a passage and an obstruction, etc. by performing histogram processing about the distance distribution of the depth map from the above-mentioned image-recognition section 21, calculates the relative-position coordinate (relative-position information) of the solid object seen from the self-vehicles 1, and outputs it to the above-mentioned narrow road judging processing section 23 and the above-mentioned two-dimensional map creation section 25.

[0023] That is, the run environmental detection means is formed as mentioned above in above-mentioned CCD camera 3, the image-recognition section 21, and the above-mentioned above-mentioned passage configuration and obstruction recognition section 22.

[0024] The above-mentioned narrow road judging processing section 23 judges whether a narrow road is in the setting range in transverse plane of abbreviation of the run direction of the self-vehicles 1 based on the relative-position information on the run

direction of the self-vehicles 1 inputted from above-mentioned passage configuration and obstruction recognition section 22.

[0025] Here, as shown in drawing 5 , when the run direction is the front, the above-mentioned setting range is a range from the body front end to about 20m, and are line α2L which added the margin to the outside of right and left of the range surrounded by tangent α1L of the outermost marginal part (for example, door mirror) of right and left of the self-vehicles 1 which extended ahead of the self-vehicles 1, and α1R, and this range, respectively, and a range surrounded by α2R. In addition, line α2L' which added the margin greatly gradually as it became far away and α2R' It is good also as a range surrounded.

[0026] The interval of obstructions, such as a wall of the guard rail of the vehicles which super-low-** or are standing it still in the run direction, and a passage edge, a curbstone, and a house, is measured, and the substantial width of road, such as a passage, is detected. and by the width of road, the maximum width of the body of the self-vehicles 1, and the relation for a margin For example, it is smaller than the value to which the width of road added a part for a 40cm margin to the maximum width of the body, and beyond the value that added a part for a 10cm margin to the maximum width of the body, in a certain case, it judges with those with a narrow road, and outputs to it at the above-mentioned two-dimensional map creation section 25.

[0027] Moreover, as a result of a judgment, when it is judged in the above-mentioned narrow road judging processing section 23 whether it can have a margin enough [ further ] and can pass, when you have no narrow road and it judges with passing being impossible (there is no path through which has only passing width of face narrower than the value which added a part for a 10cm margin to the maximum width of the body, or it can completely pass), it outputs to the above-mentioned alarm control section 24.

[0028] The above-mentioned alarm control section 24 is a signal from the above-mentioned narrow road judging processing section 23, and emits an alarm tone from the aforementioned alarm 7 that the cautions through which it cannot pass should be carried out to an operator. Volume is so large that it is close to an obstruction, and the alarm tone in this case can also be effectively reported to an operator, as the alarm interval which was being performed by carrying out intermittence also becomes short. Furthermore, when the collision with an obstruction is not avoided clearly, automatic-braking-system equipment (not shown) operates.

[0029] The handle angle θ which the above-mentioned two-dimensional map creation section 25 was formed as environmental positional information means forming, and was detected by the aforementioned handle angle sensor 6 The environmental positional

information (two-dimensional map) created in the past (last time) is updated one after another based on the relative-position information from the vehicles speed V, and the above-mentioned above-mentioned road configuration and obstruction recognition section 22 detected by the aforementioned vehicle speed sensor 5. The two-dimensional map of the environment of the self-vehicles 1 circumference including the run direction of the self-vehicles 1 is formed, and it outputs to the above-mentioned ideal path operation part 26 and the above-mentioned future-position presumption section 27.

[0030] As shown in drawing 6 , the environmental positional information (two-dimensional map) of the above-mentioned vehicles circumference is the positional information of the solid object in the field QRST centering on the self-vehicles 1 beforehand set up on XY flat surface, and is formed for the relative-position information (information in Field PQR) from above-mentioned road configuration and obstruction recognition section 22 which calculated this time and was obtained, and the information from above-mentioned road configuration and obstruction recognition section 22 obtained by last time.

[0031] namely, the field (two-dimensional map) Q of the solid object positional information which calculated last time and was memorized -- 'R' -- S -- 'T' from -- If the self-vehicles 1 move (movement magnitude M=(vehicle speed) - (measurement time)) and the relative-position information on Field PQR is newly acquired from above-mentioned road configuration and obstruction recognition section 22 this time the field Q of the last two-dimensional map -- 'R' -- S -- 'T' Only the above-mentioned movement magnitude M moves, and while updating so that it may become the information over this vehicles position the field Q of this updated last two-dimensional map -- 'R' -- S -- 'T' from -- with data (data of field TSS' T'), although it came out out of the storage region The data of the field PEF which overlaps the relative-position information on the newly obtained field PQR are eliminated, the relative-position information on the above-mentioned field PQR is added, and the field QRST of this two-dimensional map is formed. In addition, although drawing 6 shows by the case where vehicles carry out advance movement in order to make it intelligible, when vehicles carry out revolution movement, this two-dimensional map is called for similarly.

[0032] And by guiding a narrow road run using such a two-dimensional map The solid object once recognized in the direction of a rolling stock run as well as the ability to recognize the position of the solid object in the direction of a rolling stock run like before A solid object can be recognized in the large range of the vehicles circumference, without being able to grasp the position and adding a camera or solid object recognition equipment to others specially, even when it is a method of vehicle both sides with

movement of vehicles.

[0033] Here, in order to move the positional information of the last solid object based on the movement magnitude of the detected self-vehicles 1, the following calculation formulas perform.

[0034] In drawing 7, when the self-vehicles 1 go straight on, the body in A points (xa and ya) moves relatively [ points / B / (xb and yb) ] (xa =xb). Here, if the real rudder angle by the handle angle θ is set to δ, it is δ= 0, and it will be set to yb =ya- ΔM, using movement magnitude of vehicles as ΔM at the time of a rectilinear-propagation run. That is, in the time of a rectilinear-propagation run, the last two-dimensional map shown with a coordinate (xold and yold) is moved to this new two-dimensional map shown with a coordinate (xnew and ynew) by the following two formulas.

xnew =xold -- (1)

ynew =yold- ΔM -- (2)

In addition, if the above-mentioned real rudder angle δ is a value within the limits beforehand set up even if it was not 0 strictly, it will regard it as a rectilinear-propagation run. An adjustable setup of this setting range may be carried out with parameters, such as the vehicle speed.

[0035] Moreover, when the self-vehicles 1 circle, the body in B points (xb and yb) moves relatively [ points / C / (xc and yc) ] (when it is δ!=0). The main coordinate Pc (XCE, YCE) of this revolution is XCE=f (δ) as that for which it asks by reference of θble which set up XCE beforehand based on the vehicles item by the real rudder angle δ (f (δ) shows). -- (3)

YCE=(offset to axis arm) =0 -- (4)

It becomes.

[0036] furthermore, angle-of-rotation θc of revolution offset of the direction of X from a camera position to a left rear ring -- XW ** -- carrying out --

θc =ΔM/(XCE-XW) -- (5)

It is come out and computed.

[0037] The above-mentioned main coordinate Pc (XCE, YCE) and revolution angle θc It uses and the last two-dimensional map shown with a coordinate (xold and yold) is moved to this new two-dimensional map shown with a coordinate (xnew and ynew) as follows in the time of a revolution run.

r=((xold -XCE)2 +(yold -YCE)2 )1/2a=arctan((yold -YCE)/(xold -XCE))

When it carries out, it is. xnew =r-cos+(a+θc) XCE -- (6)

ynew =r-sin+(a+θc) YCE -- (7)

The above-mentioned ideal path operation part 26 is formed based on the

two-dimensional map calculated in the above-mentioned two-dimensional map creation section 25 as an ideal path operation means to calculate the path of an ideal in case there is a narrow road in the run direction of the self-vehicles 1 and the self-vehicles 1 advance into this narrow road, and the ideal path searched for by this ideal path operation part 26 is outputted to the above-mentioned information control section 28.

[0038] For example, as shown in drawing 8 (a), they are the parking vehicles H1 as an obstruction to the front of the self-vehicles 1. Parking vehicles H2 There is a narrow road SP (between θngent and the straight line L1 of the left-hand side outermost edge of the parking vehicles H1, and θngents and straight lines L2 of the right-hand side outermost edge of the parking vehicles H2) formed. When calculating the path of the ideal for advancing into this narrow road SP, a two-dimensional map as shown in drawing 8 (b) as information on two-dimensional map creation section 25 empty-vehicle both the above-mentioned circumferences is inputted.

[0039] And as shown in drawing 8 (c), it is a straight line L2 on this two-dimensional map. Straight line L3 which gave the margin beforehand set to the narrow road SP side It lengthens. Parking vehicles H1 and H2 An intersection with the straight line by the side of the self-vehicles 1 is set to Pt1, and it is a telegraph pole H3. A margin is given to the circumference by fixed width of face, and the highest point of the possibility of contact to the self-vehicles 1 side is set to Pt2.

[0040] For x=-k1 and tanh (k2 and y), and (k1) is a straight line L3 about one at the system of coordinates which took the right direction of the y-axis in the direction to which this point Pt2 is made into a zero, and a narrow road SP is gone. It considers as an asymptote and is a straight line L3 mostly in the point Pt1 neighborhood. It sets up so that it may meet. Curve L4 made by this formula A right-hand side orbit is also searched for as an ideal orbit along which the left-hand side outermost edge of the self-vehicles 1 passes.

[0041] The above-mentioned future-position presumption section 27 is a thing as a future-position presumption means. The vehicles speed from the aforementioned vehicle speed sensor 5, It is based on a two-dimensional map from the handle angle from the aforementioned handle angle sensor 6, and the above-mentioned two-dimensional map creation section 25. Setup time [ when the self-vehicles 1 maintain operational status with this on this two-dimensional map ] after The future position for which asked for the future position of (for example, 2 seconds after) by the equation of motion of the vehicles set up beforehand etc., and expected it by the vehicles item of the self-vehicles 1, and it asked is outputted to the above-mentioned information control section 28.

[0042] It is formed in the status-display sections 8, such as a monitor formed to the

aforementioned vehicle interior of a room, so that a signal output may carry out, and an information means is formed in the above-mentioned information control section 28 and this status-display section 8 so that the above-mentioned information control section 28 compounds the ideal path searched for by the above-mentioned ideal path operation part 26, and the future position for which it asked in the above-mentioned future-position presumption section 27 and it may make display on [ both ] the two-dimensional map created in the above-mentioned two-dimensional map creation section 25. for this reason, an operator -- the status-display section 8 -- **** -- by things, the operation which should be performed from now on while being able to recognize the possibility of evasion of an obstruction easily, and the obstruction information which can recognize easily quickly and has not been noticed can be known now

[0043] Next, an operation of the operation support equipment for vehicles by the above-mentioned composition is explained based on the flow chart of drawing 3 . First, if a program starts, while the vehicle speed sensor 5 will detect the speed V of the self-vehicles 1, and the handle angle sensor 6 will detect the handle angle θ of the self-vehicles 1 and reading at Step (it is called "S" for short below) 101, the environment of the run direction of the self-vehicles 1 is picturized by CCD camera 3 on either side, and it incorporates in the image-recognition section 21 of a control unit 4. 1 set of these stereo picture pairs are the above-mentioned image-recognition sections 21, and processing which searches for the distance information over the whole picture by the principle of triangulation is performed from the amount of gaps of a corresponding position, the depth map showing the distance distribution of three dimensions is generated, and they are outputted to a road configuration and the obstruction recognition section 22. And in this road configuration and obstruction recognition section 22, solid objects, such as a road and an obstruction, etc. are recognized by performing histogram processing about the distance distribution of the depth map from the above-mentioned image-recognition section 21, calculation of the relative-position coordinate (relative-position information) of the solid object seen from the self-vehicles 1 is performed, and it is outputted to the above-mentioned narrow road judging processing section 23 and the above-mentioned two-dimensional map creation section 25 (that is, reading of a road and obstruction information is performed).

[0044] Then, it progresses to S102 and the judgment of whether a narrow road is in travelling direction (inside of the setting range in transverse plane of abbreviation of the run direction of the self-vehicles 1) is performed. The interval of obstructions, such as a wall of the guard rail of the vehicles which super-low-** or are standing it still in the run direction, and a road edge, a curbstone, and a house, is measured, and the

substantial width of road D, such as a road, is detected. and by the width of road D, the maximum width W of the body of the self-vehicles 1, and the relation for a margin For example, it is smaller than the value which added a part for a 40cm margin to the maximum width W of the body, and by making into a narrow road the width of road D beyond the value which added a part for a 10cm margin to the maximum width W of the body (W+10 <=D<W +40), when you have no narrow road (in the case of W+10>D or D>=W +40), it progresses to S103.

[0045] In the above S103, it judges whether it is the path which can further pass through the above-mentioned path (path which is not a narrow road), when it is a path with sufficient margin to run, i.e., the path of D>=W +40, it returns to the above S101, and the case of the path through which it cannot pass, i.e., the path of W+10>D, progresses to S104. In addition, the above S102 and S103 is processings performed in the narrow road judging processing section 23.

[0046] If it progresses to the above S104, the alarm control section 24 will emit an alarm tone from the alarms 7, such as a buzzer, that the cautions through which it cannot pass should be carried out to an operator. Volume is so large that it is close to an obstruction, and the alarm tone in this case is also effectively reported to an operator, as the alarm interval which was being performed by carrying out intermittence also becomes short. Furthermore, when the collision with an obstruction is not avoided clearly, automatic-braking-system equipment (not shown) operates. And it escapes from a program after this processing of S104.

[0047] On the other hand, when a narrow road is in the travelling direction of the self-vehicles 1 by the above S102, it progresses to S105 (when it is W+10 <=D<W +40). If it progresses to these S105, the environmental positional information (two-dimensional map) created in the past (last time) in the above-mentioned two-dimensional map creation section 25 according to the two-dimensional map generating routine mentioned later based on the handle angle θ, the vehicles speed V, and relative-position information (a road and obstruction information) will be updated one after another, and the two-dimensional map of the environment of the self-vehicles 1 circumference including the run direction of the self-vehicles 1 will be formed.

[0048] Then, it progresses to S106, and in case there is a narrow road in the run direction of the self-vehicles 1 by the ideal path operation part 26 based on the two-dimensional map calculated in the above-mentioned two-dimensional map creation section 25, the path of an ideal in case the self-vehicles 1 advance into this narrow road is calculated.

[0049] Subsequently, it progresses to S107, and in the future-position presumption

section 27, based on the handle angle θ, the vehicles speed V, and a two-dimensional map, it asks for the future position after the setup time when the self-vehicles 1 maintain operational status with this on this two-dimensional map (for example, after 2 seconds) by the equation of motion of the vehicles set up beforehand etc., and it is expected by the vehicles item of the self-vehicles 1.

[0050] And compound the ideal path which carried out the signal output of the information control section 28 at the status-display sections 8, such as a monitor formed in the vehicle interior of a room, and was searched for by the above-mentioned ideal path operation part 26, and the future position for which it asked in the above-mentioned future-position presumption section 27, and it is made to display by progressing to S108 on [ both ] the two-dimensional map created in the above-mentioned two-dimensional map creation section 25 as shown in drawing 9 , and escapes from a program.

[0051] for this reason, an operator -- the status-display section 8 -- **** -- by things, the operation which should be performed from now on while being able to recognize the possibility of evasion of an obstruction easily, and the obstruction information which can recognize easily quickly and has not been noticed can be known

[0052] Next, if drawing 4 shows the flow chart of the two-dimensional map generating routine performed in the two-dimensional map creation section 25 and this routine starts it First, the real rudder angle δ according to the handle angle θ at S201, vehicles movement magnitude ΔM (from the vehicle speed and measurement time to an operation), After that, the last two-dimensional map is read, and it progresses to S202, and a revolution state or a rectilinear-propagation state is judged from the value of the real rudder angle δ, and, in the case of a rectilinear-propagation state, it progresses S203, and, in the case of a revolution state, progresses S204.

[0053] If it judges with a rectilinear-propagation state by the above S202 and progresses to S203, vehicles movement magnitude ΔM will be added to the last two-dimensional map (performing processing based on the aforementioned (1) formula and (2) formulas), and it will progress to S206.

[0054] When it judges with a revolution state by the above S202 and progresses to S204, on the other hand, the real rudder angle δ Vehicles movement magnitude ΔM to the center line of rotation PC, and revolution angle θc It computes (calculation based on the aforementioned (3) formula, (4) formulas, and (5) formulas). It progresses to S205 and is the above-mentioned center line of rotation PC about the last two-dimensional map. It is revolution angle θc to a center. It is made to rotate (performing processing based on the aforementioned (6) formula and (7) formulas), and progresses to S206.

[0055] If it progresses to S206 from the above S203 or the above S205, although it came out out of the storage region by processing of the above S203 or the above S205, data will be eliminated in the last two-dimensional map.
[0056] Subsequently, it progresses to S207 and the data which overlap the new relative-position information on a solid object by processing of the above S203 or the above S205 in the last two-dimensional map are eliminated.
[0057] next, the last two-dimensional map which progressed to S208, read the relative-position coordinate (relative-position information) of the solid object seen from the self-vehicles 1, progressed to S209, and was formed by the above S207 -- the above -- new relative-position information is added and memorized This solid object positional information is the new two-dimensional map updated this time.
[0058] In addition, in case a control program is performed next time, this memorized new two-dimensional map is read as last two-dimensional map, and is processed. Thus, in order to create a two-dimensional map, even when the solid object once recognized ahead [ vehicles ] is a method of vehicle both sides with movement of vehicles, the position can be grasped, and it is possible to also offer easily operation support for the obstruction which exists in the method of vehicle both sides as well as the operation support for the obstruction which exists ahead [ vehicles ].
[0059] When making a car park as mentioned above according to the 1st form of operation of this invention, no matter it may compare in the direction it runs corresponding to various situations of an except and there may be what obstruction, this is reported to an operator, an operator makes a quick adequate judgment easily and contact with an obstruction is avoided, and it guides, and it is certain and becomes the high thing of reliability and practicality so that a narrow road run can be performed.
[0060] Next, as for drawing 10 - drawing 13 , the functional block diagram of the operation support equipment for vehicles and drawing 11 of drawing 10 are explanatory drawings in which the outline block diagram of the operation support equipment for vehicles and drawing 12 show the flow chart of narrow road guide control, and drawing 13 shows an example of the display to a monitor with respect to the 2nd form of operation of this invention. In addition, while the 2nd form of operation of this invention displays the future position of the self-vehicles presumed in the ideal path calculated by ideal path operation part, and the future-position presumption section Based on the above-mentioned ideal path and the above-mentioned future position, the amount of blanks from the above-mentioned ideal path of the above-mentioned future position of self-vehicles is calculated. While calculating the amount of speed corrections and the amount of rudder angle corrections which make this amount of blanks the minimum

and displaying these on predetermined, according to a self-rolling-stock-run state, adjustable [ of the above-mentioned amount of speed corrections and the above-mentioned amount of rudder angle corrections ] is carried out, a voice output is carried out to predetermined, and a narrow road run is guided.

[0061] In drawing 10 , a sign 41 shows the operation support equipment for vehicles, and the video signal of the run direction of the self-vehicles 1 which picturized this operation support equipment for vehicles by 1 set of CCD cameras 3 is inputted into a control unit 42.

[0062] moreover, the above-mentioned operation support equipment 41 for vehicles like the 1st form of implementation of the aforementioned invention as a run state detection means It is formed so that each detecting signal from the vehicle speed sensor 5 and the handle angle sensor 6 may be inputted into the above-mentioned control unit 42. The above-mentioned control unit 42 is based on each above-mentioned information. The judgment of the propriety of narrow road penetration, That the function which aims at contact prevention with an obstruction and guides a run of a narrow road should be attained, it is constituted so that a control output may be carried out to an alarm 7, the status-display section 8, the operation guide display 43, left voice output section 44L, and right voice output section 44R.

[0063] As shown in the monitor formed in in the car at drawing 13 according to the output signal (the amount of rudder angle corrections and the amount of speed corrections which are mentioned later) from the above-mentioned control unit 42, the above-mentioned operation guide display 43 is displayed with the above-mentioned status-display section 8 (area of Ap), it should just correct how many handle angles, should just correct how many the vehicle speed, or (area of APV) displays it visually.

[0064] Moreover, the voice output sections 44L and 44R of the above-mentioned right and left It responds to an output signal (the above-mentioned amount of rudder angle corrections, and the amount of speed corrections) from the above-mentioned control unit 42. If it is the directions to the left, while operating the above-mentioned left voice output section 44L, for example, carrying out [ "please turn a handle a little leftward" and ] a voice output using the sound signal beforehand recorded on the record medium If it is the directions to the right, the above-mentioned right voice output section 44R will be operated, for example, a voice output will be carried out [ "please turn a handle a little rightward" and ] (in adjustable directions of only speed, it carries out from voice output section 44L [ of the above-mentioned right and left ], and 44R both).

[0065] The timing which carries out a voice output is beforehand changed from the voice output sections 44L and 44R of the above-mentioned right and left here by the present

vehicle speed and present acceleration with the above-mentioned control unit 42. For example, if it becomes during acceleration even if the present vehicle speed is low, it will utter an early voice output, and if it becomes during a slowdown, it will utter a voice output later.

[0066] The above-mentioned control unit 42 is formed in a microcomputer and its circumference circuit, and as shown in drawing 10 , it mainly consists of the image-recognition section 21, a road configuration and the obstruction recognition section 22, the narrow road judging processing section 23, the alarm control section 24, the two-dimensional map creation section 25, ideal path operation part 26, the future-position presumption section 27, and an information control section 45.

[0067] The above-mentioned information control section 45 compounds the ideal path searched for by the above-mentioned ideal path operation part 26, and the future position for which it asked in the above-mentioned future-position presumption section 27, and it is formed in the status-display sections 8, such as a monitor formed in the aforementioned vehicle interior of a room, so that it may be made to display on [ both ] the two-dimensional map created in the above-mentioned two-dimensional map creation section 25, and a signal output may be carried out. Moreover, the above-mentioned information control section 45 calculates the amount of blanks from the above-mentioned ideal path of the above-mentioned future position of the self-vehicles 1 based on the above-mentioned ideal path and the above-mentioned future position, and the amount of speed corrections and the amount of rudder angle corrections which make this amount of blanks the minimum are calculated based on a vehicles item. While outputting these to the above-mentioned operation guide display 43, according to a self-rolling-stock-run state (the present speed, acceleration), adjustable [ of the generating timing ] is carried out and the signal output of the above-mentioned amount of speed corrections and the above-mentioned amount of rudder angle corrections is carried out at the voice output sections 44L and 44R of the above-mentioned right and left. That is, the information means is formed in the above-mentioned information control section 45, the status-display section 8, the operation guide display 43, and the voice output sections 44L and 44R on either side.

[0068] With the 2nd form of operation of this invention with such composition, as shown in the flow chart of drawing 12 , a program is performed. The processing same to S101-S107 as the 1st form of implementation of the aforementioned invention is performed, and the 2nd form of operation of this invention is the above S107. It progresses to S301, after asking for the future position after the setup time when the self-vehicles 1 maintain operational status with this on this two-dimensional map by

the equation of motion of the vehicles set up beforehand etc. and expecting it by the vehicles item of the self-vehicles 1 based on the handle angle θ, the vehicles speed V, and a two-dimensional map.

[0069] In the above S301, based on the above-mentioned ideal path and the above-mentioned future position, the amount of blanks from the above-mentioned ideal path of the above-mentioned future position of the self-vehicles 1 is calculated by the information control section 45, and the amount of speed corrections and the amount of rudder angle corrections which make this amount of blanks the minimum are calculated based on a vehicles item.

[0070] It progresses to S302. and the above-mentioned information control section 45 While carrying out a signal output at the status-display sections 8, such as a monitor formed in the vehicle interior of a room, so that the above-mentioned ideal path and the above-mentioned future position may be compounded and it may be made to display on [ both ] a two-dimensional map While outputting and displaying the above-mentioned amount of speed corrections, and the above-mentioned amount of rudder angle corrections on the operation guide display 43 According to a self-rolling-stock-run state (the present speed, acceleration), adjustable [ of the generating timing ] is carried out, a signal output is carried out, and the voice output of the above-mentioned amount of speed corrections and the above-mentioned amount of rudder angle corrections is carried out to the voice output sections 44L and 44R of the above-mentioned right and left, and they carry out a run guide.

[0071] Thus, with the 2nd form of operation of this invention, by in addition to the effect in the 1st form of the above, calculating the amount of speed corrections, and the amount of rudder angle corrections, and displaying these on predetermined, an operator checks by looking the amount of speed corrections and the amount of rudder angle corrections which should be performed from now on, and can recognize now more quickly the operation which should be performed from now on easily.

[0072] Moreover, since the voice output of the amount of speed corrections and the amount of rudder angle corrections is carried out, even if an operator cannot check a display in the car etc. by looking and cannot check an obstruction position, he is guided in it so that the above-mentioned ideal path may certainly be met. And since it is carried out by carrying out adjustable [ of the timing of this voice output ] according to a self-rolling-stock-run state, a voice guide is carried out with parameters, such as vehicles speed and acceleration, at suitable time, and operation becomes still easier.

[0073] In addition, although the example which formed the vehicle speed sensor and the handle angle sensor as a run state detection means explains, other sensors are added

further and you may make it control them by the form of implementation of each above-mentioned invention. For example, a yaw rate sensor etc. is prepared and it is good also considering a yaw rate as a control parameter.

[0074]

[Effect of the Invention] As explained above, no matter according to this invention it may compare in the direction it runs and there may be what obstruction, this is reported to an operator, and it is guided so that an operator may make a quick adequate judgment easily, contact with an obstruction may be avoided and a narrow road run can be performed, and the outstanding effect that it is certain and reliability and practicality are high is done so.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is involved in the 1st gestalt of operation of this invention, and is the functional block diagram of the operation support equipment for vehicles.

[Drawing 2] The same as the above, the outline block diagram of the operation support equipment for vehicles

[Drawing 3] The flow chart of the same as the above and narrow road guide control

[Drawing 4] The flow chart of the same as the above and a two-dimensional map generating routine

[Drawing 5] Explanatory drawing of the range of the same as the above and a narrow road judging

[Drawing 6] Explanatory drawing of the same as the above and the solid object positional information of the vehicles circumference

[Drawing 7] Explanatory drawing at the time of moving the same as the above and the last solid object positional information

[Drawing 8] Explanatory drawing showing an example which sets an ideal path as the narrow road the same as the above and ahead of vehicles

[Drawing 9] The same as the above, explanatory drawing showing an example of the display to a monitor

[Drawing 10] It is involved in the 2nd gestalt of operation of this invention, and is the functional block diagram of the operation support equipment for vehicles.

[Drawing 11] The same as the above, the outline block diagram of the operation support equipment for vehicles

[Drawing 12] The flow chart of the same as the above and narrow road guide control

[Drawing 13] The same as the above, explanatory drawing showing an example of the display to a monitor

[Description of Notations]

1 Self-Vehicles

2 Operation Support Equipment for Vehicles

3 CCD Camera (Run Environmental Detection Means)

4 Control Unit

5 Vehicle Speed Sensor (Run State Detection Means)

6 Handle Angle Sensor (Run State Detection Means)

7 Alarm

8 Status-Display Section (Information Means)

21 Image-Recognition Section (Run Environmental Detection Means)

22 Passage Configuration and Obstruction Recognition Section (Run Environmental Detection Means)

23 Narrow Road Judging Processing Section

24 Alarm Control Section

25 Two-dimensional Map Creation Section (Environmental Positional Information Means Forming)

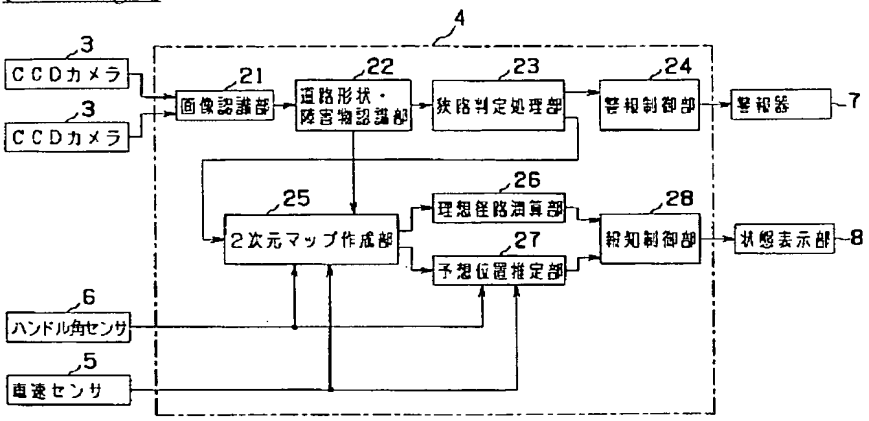
26 Ideal Path Operation Part (Ideal Path Operation Means)

27 Future-Position Presumption Section (Future-Position Presumption Means)

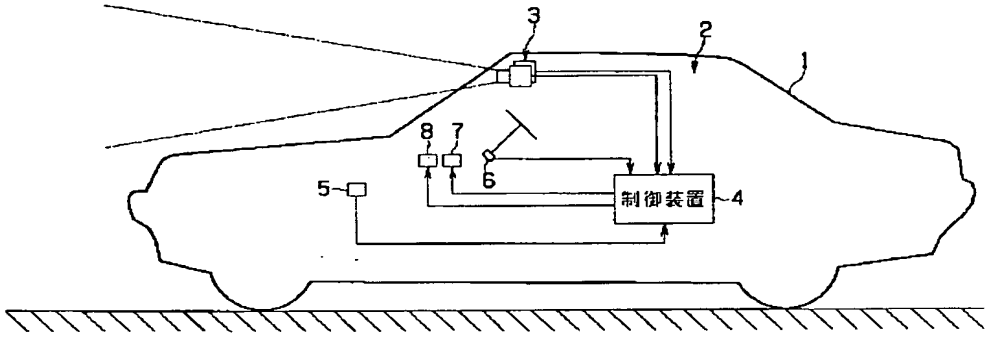
28 Information Control Section (Information Means)

## DRAWINGS

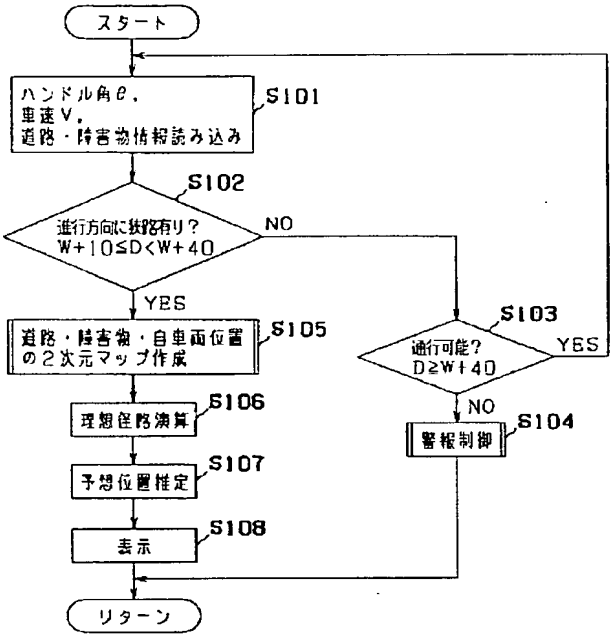
[Drawing 1]



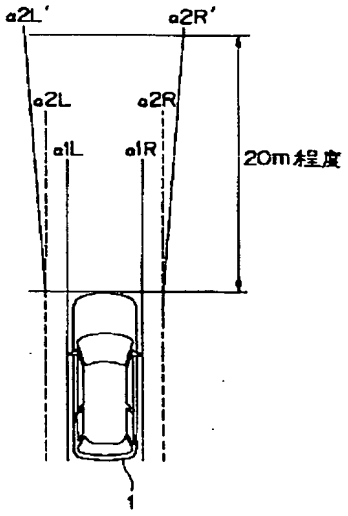

[Drawing 2]



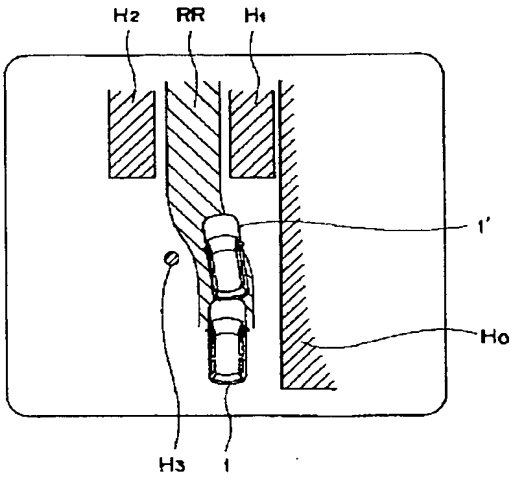

[Drawing 3]



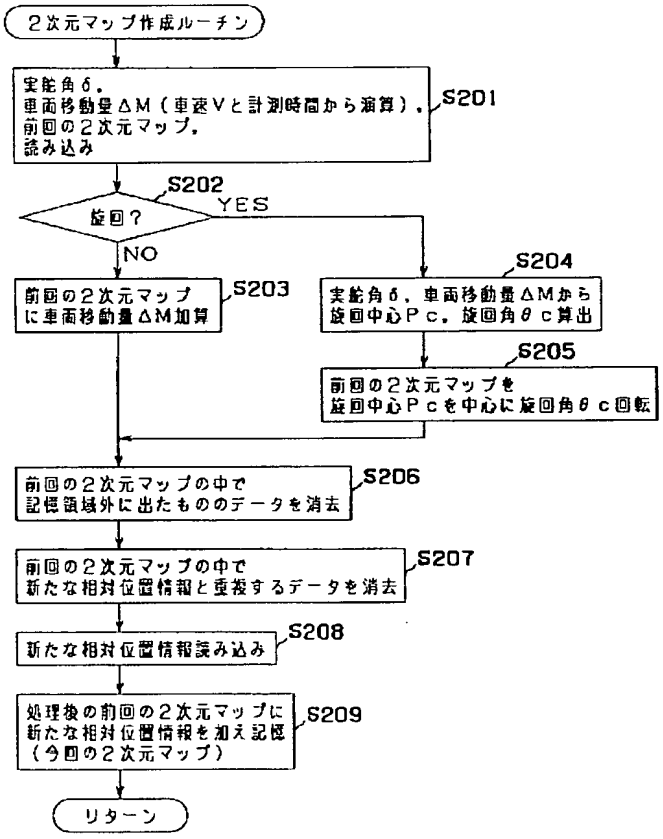

[Drawing 5]



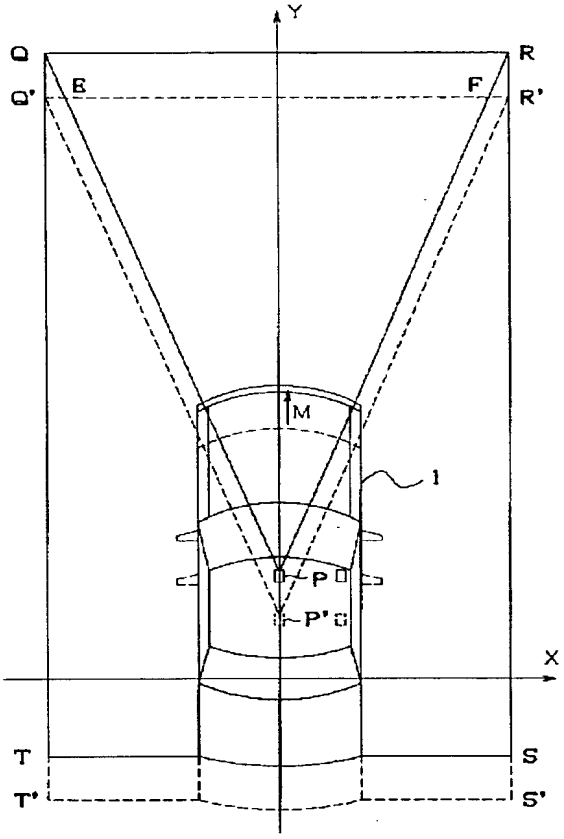

[Drawing 9]



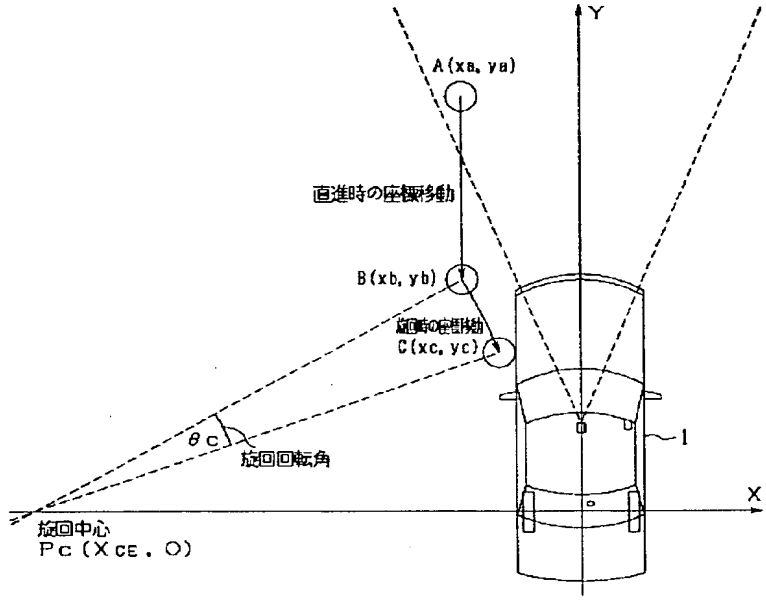

[Drawing 4]



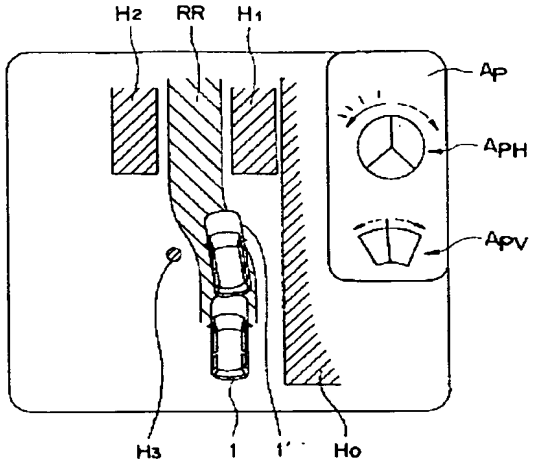

[Drawing 6]


Y
Q
Q'
E
F
R
R'
M
1
P
P'
X
T
T'
S
S'

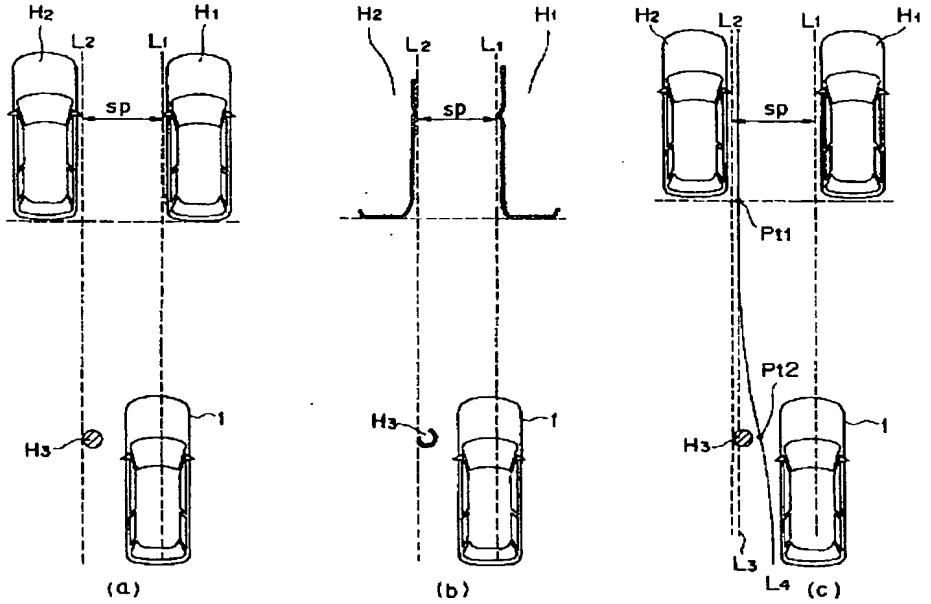
[Drawing 7]


Y
A(xa, ya)
直進時の座標移動
B(xb, yb)
旋回時の座標移動
C(xc, yc)
θc
旋回回転角
1
X
旋回中心
Pc (Xce , 0)

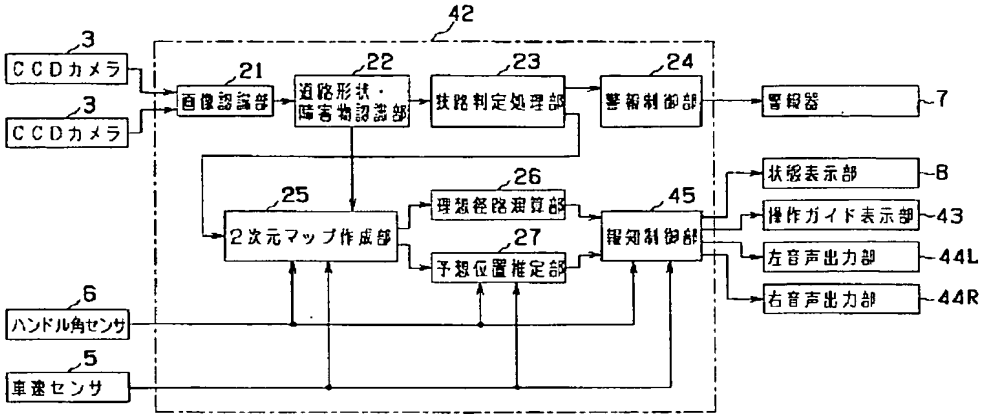
[Drawing 13]



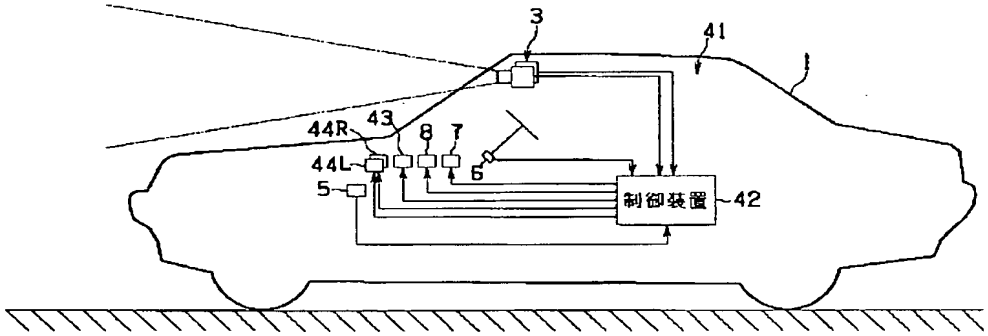

[Drawing 8]



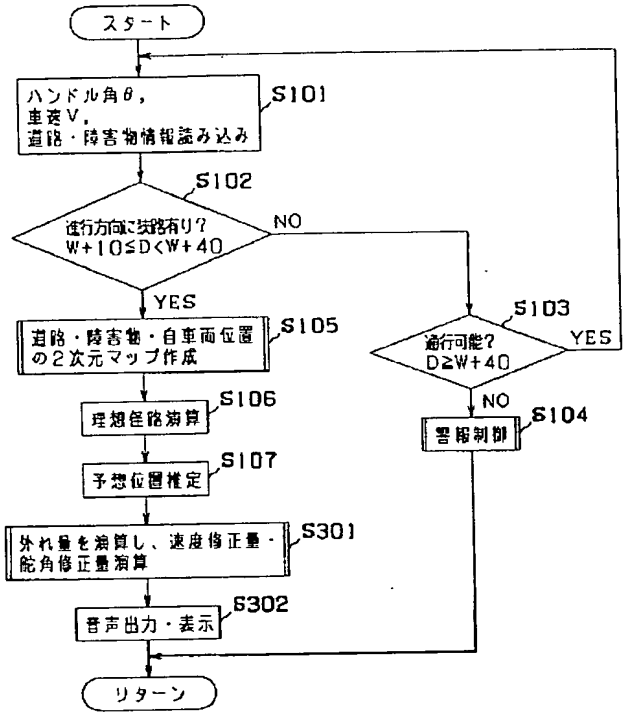

[Drawing 10]


42
3
CCDカメラ
3
CCDカメラ
21
画像認識部
22
道路形状・障害物認識部
23
状態判定処理部
24
警報制御部
警報器
7
状態表示部
8
操作ガイド表示部
43
左音声出力部
44L
右音声出力部
44R
25
2次元マップ作成部
26
理想経路演算部
27
予想位置推定部
45
報知制御部
6
ハンドル角センサ
5
車速センサ

[Drawing 11]


3
41
44R
43
8
7
6
44L
5
制御装置
42

[Drawing 12]


スタート
ハンドル角θ，
車速V，
道路・障害物情報読み込み
S101
S102
進行方向に支路有り?
W+10≤D<W+40
NO
YES
S103
通行可能?
D≥W+40
YES
NO
S104
警報制御
S105
道路・障害物・自車両位置
の2次元マップ作成
S106
理想経路演算
S107
予想位置推定
S301
外れ量を演算し、速度修正量・
舵角修正量演算
S302
音声出力・表示
リターン